

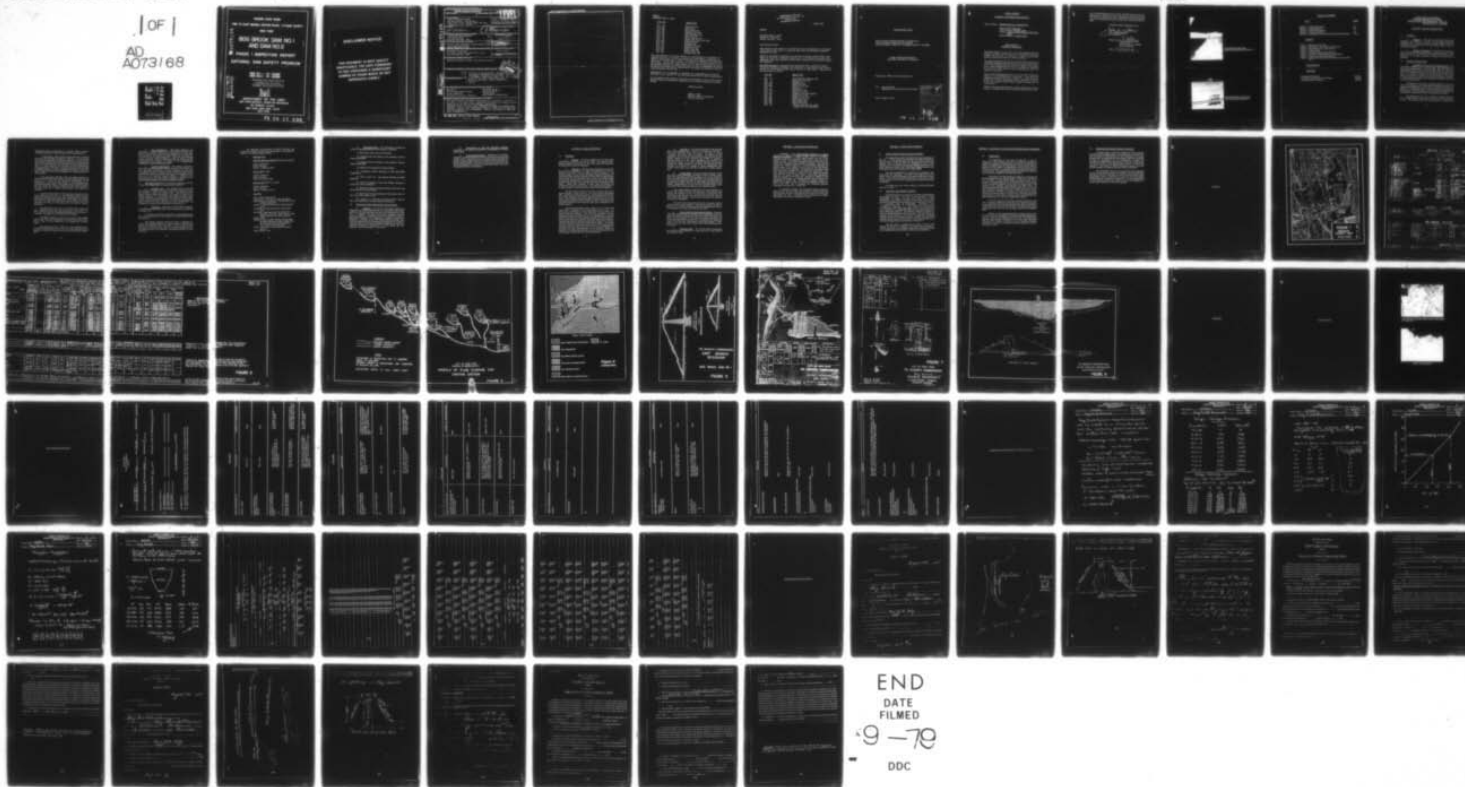
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NEW YORK STATE DEPT OF ENVIRONMENTAL CONSERVATION ALBANY F/G 13/2  
NATIONAL DAM SAFETY PROGRAM. BOG BROOK DAM NUMBER 1 (NY-00068) --ETC(U)  
SEP 78 J J WILLIAMS DACW51-78-C-0035

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HUDSON RIVER BASIN

TRIB. TO EAST BRANCH CROTON RIVER, PUTNAM COUNTY

NEW YORK

**BOG BROOK DAM NO. 1  
AND DAM NO. 2**

**PHASE I INSPECTION REPORT**

**NATIONAL DAM SAFETY PROGRAM**

**DAM NO. 1 - NY 00068  
DAM NO. 2 - NY 00069**

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**DEPARTMENT OF THE ARMY  
NEW YORK DISTRICT, CORPS OF ENGINEERS  
26 FEDERAL PLAZA  
NEW YORK, NEW YORK 10007  
JULY 1978**

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## REPORT DOCUMENTATION PAGE

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1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT CATALOG NUMBER
4. TITLE (and Subtitle) Phase I Inspection Report Bog Brook Dam No. 1 and Dam No. 2 Hudson River Basin, Putnam County, New York Inventory No. N.Y. 68 & 69		5. TYPE OF REPORT & PERIOD COVERED Phase I Inspection Report National Dam Safety Program
7. AUTHOR(s) John J. Williams, P.E.		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS O'Brien and Gere Engineers 1301 Buckley Road Syracuse, New York 13221		8. CONTRACT OR GRANT NUMBER(s) DACW-51-78-C-0035
11. CONTROLLING OFFICE NAME AND ADDRESS New York State Department of Environmental Conservation/ 50 Wolf Road Albany, New York 12233		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 12 75p
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) Department of the Army 26 Federal Plaza/ New York District, CofE New York, New York 10007		12. REPORT DATE 18 September 1978
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; Distribution unlimited.		13. NUMBER OF PAGES
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 6 National Dam Safety Program. Bog Brook Dam Number 1 (NY-00068) and Dam Number 2 (NY-00069), Hudson River Basin, Tributary to East Branch Croton River, Putnam County, New York. Phase I Inspection Report.		15. SECURITY CLASS. (of this report) UNCLASSIFIED
18. SUPPLEMENTARY NOTES		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Dam Safety Bog Brook Dam No. 1 National Dam Safety Program Bog Brook Dam No. 2 Visual Inspection Putnam County Hydrology, Structural Stability East Branch of Croton River		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization. Bog Brook Dam No. 1 and No. 2 were inspected and judged to be unsafe, non-emergency. Dam No. 1 has significant seepage at junction of the north abutment and downstream face of embankment. Dam No. 2 has growth of trees and brush on embankment.		

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REPORT DOCUMENTATION PAGE

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NANEN-F

Honorable Hugh L. Carey

<u>I.D. NO.</u>	<u>NAME OF DAM</u>
N.Y. 49	Pocantico Dam
N.Y. 445	Attica Dam
N.Y. 658	Cork Center Dam
N.Y. 153	Jackson Creek Dam
N.Y. 172	Lake Algonquin Dam
N.Y. 318	Sixth Lake Dam
N.Y. 13	Butlet Storage Dam
N.Y. 90	Putnam Lake (Bog Brook Dam)
N.Y. 166	Pecks Lake Dam
N.Y. 674	Bradford Dam
N.Y. 75	Sturgeon Pool Dam
N.Y. 414	Skaneateles Dam
N.Y. 155	Indian Lake Dam
N.Y. 472	Newton Falls Dam
N.Y. 362	Buckhorn Lake Dam

The classification of "unsafe" applied to a dam because of a seriously inadequate spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean, however, that based on an initial screening, and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard to loss of life downstream from the dam.

Consequently, it is advisable to implement the recommendations previously furnished in the reports for the above-mentioned dams as soon as practicable.

It is requested that owners of these dams be furnished a copy of this letter and that copies be permanently appended to all reports previously furnished to you.

Sincerely yours,

CLARK H. BENN  
Colonel, Corps of Engineers  
District Engineer

DEPARTMENT OF THE ARMY  
U. S. ARMY ENGINEER DISTRICT, NEW YORK  
26 FEDERAL PLAZA  
NEW YORK, NEW YORK 10007

2 OCT 1978

NANEN-F

Honorable Hugh L. Carey  
Governor of New York  
Albany, New York 12224

Dear Governor Carey:

The purpose of this letter is to inform you of a clarification of the guidelines used by this office in assessing dams under the National Program of Inspection of Dams.

Office of the Chief of Engineers has recently provided a clarification that dams with seriously inadequate spillways are to be assessed as unsafe, non-emergency, until more detailed studies prove otherwise or corrective measures are completed.

The following dams in your state have previously been assessed as having seriously inadequate spillways, with capability to pass safely only the percentage of the probable maximum flood as noted in each report. They are now to be assessed as unsafe:

<u>I.D. NO.</u>	<u>NAME OF DAM</u>
N.Y. 59	Lower Warwick Reservoir Dam
N.Y. 4	Salisbury Mills Dam
N.Y. 45	Amawalk Dam
N.Y. 418	Jamesville Dam
N.Y. 685	Colliersville Dam
N.Y. 6	Delta Dam
N.Y. 421	Oneida City Dam
N.Y. 39	Croton Falls Dam
N.Y. 509	Chadwick Dam (Plattenkill)
N.Y. 66	Boyds Corner Dam
N.Y. 397	Cranberry Lake Dam
N.Y. 708	Seneca Falls Dam
N.Y. 332	Lake Sebago Dam
N.Y. 338	Indian Brook Dam
N.Y. 33	Lower(S) Wiccopee Dam (Lower Hudson W.S. for Peekskill)

# HUDSON RIVER BASIN

Name of Dams: Bog Brook Dam No. 1 and Dam No. 2  
County and State: Putnam County, New York  
Inventory Numbers: Dam No. 1 - NY 00068; Dam No. 2 - NY 00069

## PHASE I INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM

Prepared by: O'Brien and Gere Engineers, Inc.

For: New York State  
Department of Environmental Conservation

Date: August 17, 1978

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PHASE I REPORT  
NATIONAL DAM INSPECTION PROGRAM

Name of Dams: Bog Brook Dam No.1 and Dam No.2

State Located: New York

County Located: Putnam County

Stream: Tributary to East Branch of the Croton  
River

Date of Inspection: July 17, 1978

ASSESSMENT OF  
GENERAL CONDITIONS

Bog Brook Dams No. 1 and No. 2 are earth embankments with masonry corewalls. Neither structure is provided with a spillway; however, the reservoir is connected by a tunnel to East Branch Reservoir which is provided with a 500 foot spillway.

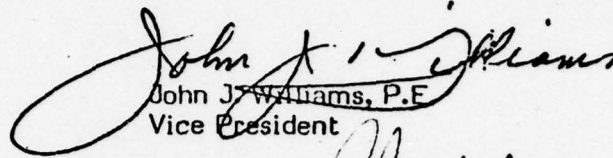
Two major depressions were observed along the crest of Dam No. 1; significant seepage and saturated ground were noted at the junction of the north abutment and the downstream slope of the embankment. These conditions should be further investigated to determine the source or cause, and how these conditions may affect the stability of Dam No. 1.

The trees and brush growing on Dam No. 2 may have a deleterious affect on the compacted earth embankment. Trees, brush and vegetation growing on Dam No. 2 should be cut near the ground surface and a further investigation made to determine the extent of the root systems before further remedial measures can be recommended.

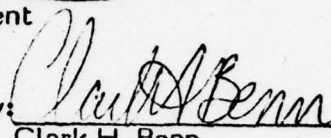
Results of the hydrologic/hydraulic analysis indicate that the dams could be overtopped by all floods exceeding approximately 83 per

cent of the Probable Maximum Flood. The East Branch spillway is hydraulically inadequate to pass flood flows associated with the PMF; however, the spillway is not considered "seriously inadequate" as cited in Engineering Technical Letter No. 1110-2-234, May 10, 1978.

O'BRIEN & GERE ENGINEERS, INC.

  
John J. Williams, P.E.  
Vice President

Approved by:

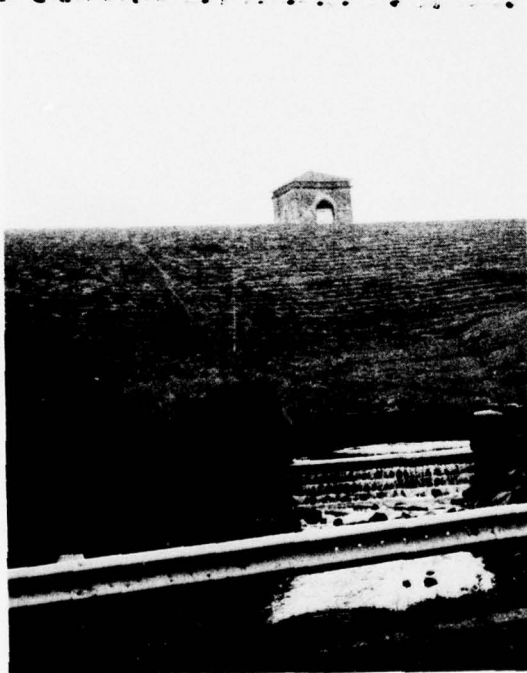
  
Clark H. Benn  
Colonel, Corps of Engineers  
District Engineer

Date:

18 September 78



UPSTREAM SLOPE AND  
CENTER GATEHOUSE DAM NO. 1



DOWNSTREAM SLOPE AND  
STILLING BASIN DAM NO. 1

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PHASE I INSPECTION REPORT  
NATIONAL DAM SAFETY PROGRAM  
NAME OF DAMS BOG BROOK NO. 1 ID# 00068  
BOG BROOK NO. 2 ID# 00069

SECTION I - PROJECT INFORMATION

1.1 GENERAL

a. Authority - This report is authorized by the Dam Inspection Act, Public Law 92-367, and has been prepared in accordance with contract #1467.021 between O'Brien and Gere Engineers, Inc. and the New York State Department of Environmental Conservation.

b. Purpose of Inspection - The purpose of this inspection is to evaluate the structural and hydraulic conditions of Bog Brook Dam No. 1 and Dam No. 2 and appurtenant structures, and to determine if the dams constitute a hazard to human life or property.

1.2 PROJECT DESCRIPTION

a. Description of Dams and Appurtenances (From information supplied by the City of New York, Department of Environmental Protection) - The Bog Brook dams are located in southeastern Putnam County about 1½ miles east of Brewster, New York. The impoundment area was formed by the construction of Dam No. 1, across a tributary to the East Branch of the Croton River, and Dam No. 2, which was constructed across a depression on the dividing line between the watershed of Bog Brook and that of another small stream.

According to the section drawings supplied by the New York City Department of Environmental Protection, both dams are rolled earth embankments with masonry corewalls extending into bedrock. The upstream slope of both structures is protected by stone riprap. Each embankment is provided with a downstream toe drainage ditch consisting of a trench backfilled with cobbles.

Bog Brook Dam No. 1 has a maximum height of about 47 feet, is approximately 1,340 feet long and has a top width of about 25 feet. The upstream slope is 2½ horizontal to 1 vertical; the

downstream slope is 2 horizontal to 1 vertical. Refer to Figure 5 for details concerning transverse sections of this embankment.

A rectangular, stone masonry outlet structure is situated near the crest and near the center of Dam No. 1. Flow into the structure is accomplished through four openings: one at the toe of the upstream slope, one at mid-height and two at operating pool level. The two lower inlets are controlled by sluice gates (each 3 feet by 5 feet) housed in the structure and are provided with stoplogs upstream of the gates. The upper two inlets are controlled by stoplogs placed in a slot immediately downstream of the sluice gates. Refer to Figure 6 of the appendix for a detailed section of this structure.

Two thirty-inch diameter cast iron pipes, housed in a horseshoe-shaped brick-lined culvert, convey the discharge through Dam No. 1. About 30 feet beyond the downstream toe of embankment, the conduits pass through a vault containing two horizontal stem gate valves. The pipes continue downstream about 200 feet where the discharge from each pipe exits through a fountain orifice into a common stilling basin. (See Figure 8 of Appendix).

A second stone masonry outlet structure is situated on the south abutment of Dam No. 1. This structure houses two gate valves and a butterfly valve which control discharge into a 10 foot diameter, brick-lined connecting tunnel. (See Figure 7 for details). The tunnel is 2,200 feet long and is used to maintain the same operating pool level in Bog Brook and East Branch (Sodom) Reservoirs.

Bog Brook Dam No. 2 has a maximum height of about 23 feet, is approximately 1,936 feet long and has a top width of 12 feet. Both the upstream and downstream slopes are 2 horizontal to 1 vertical. See Figure 5 for transverse section details.

Bog Brook Reservoir is part of the Croton Water Supply System; the Dams and Appurtenant Structures are owned by the City of New York and operated by the Department of Water Supply.

Bog Brook Dams No. 1 and No. 2 were designed by the Aqueduct Commissioners, City of New York and were constructed by David R. Paige & Company between February 1889 and August 1893.

b. Size Classification - Big Brook Reservoir was designed for a storage volume of 4.4 billion gallons (13,500 acre-feet) at the maximum operating pool elevation of 417 feet mean sea level (MSL). The maximum heights of Dam No. 1 and Dam No. 2 are 47 feet and 23 feet respectively. Since the normal storage volume is between 1,000 and 50,000 acre-feet, the dams are in the intermediate size category as defined by the Recommended Guidelines for Safety Inspection of Dams.

c. Hazard Classification - The Village of Brewster, New York is located within  $1\frac{1}{2}$  miles of Dam No. 1 and Dam No. 2. The topography downstream of both structures is such that overtopping or failure of either structure would direct flood waters towards the Village of Brewster resulting in the possible loss of many lives and extensive property damage. Therefore, both structures are in the high hazard category as defined by the Recommended Guidelines for Safety Inspection of Dams.

1.3 PERTINENT DATA (From information supplied by the City of New York, Department of Environmental Protection)

a) Drainage Area - The drainage area of the Bog Brook Reservoir is about 3.73 square miles and the surface area of the reservoir is about 0.64 square miles. Bog Brook and East Branch (Sodom) Reservoirs together form what is known as the "Double Reservoir 1". While these two basins have about equal storage capacities, the watershed of East Branch is about twenty times as large as Bog Brook Reservoir. Therefore, to equalize the supply received by each reservoir, the two impoundments are connected by a tunnel which is described in Section 1.2.a.

b. Discharges - Discharge from Bog Brook Reservoir is accomplished through operation of two sluice gates as described in Section 1.2.a.

A statutory conservation discharge of 5 million gallons per day must be maintained to the tributary to the East Branch of the Croton River.

East Branch (Sodom) Reservoir, which is operated in tandem with Bog Brook Reservoir, is provided with a 500 foot long spillway at Elevation 416.55 feet MSL. Since no spillway was constructed at the Bog Brook site, the discharge capacity of the East Branch spillway was apparently considered adequate for both reservoirs.

The maximum pool elevation of 419.15 feet MSL was recorded on October 16, 1955 and corresponds to a discharge of 6,240 cfs over the East Branch spillway.

c. Reservoir Data

Maximum Operating Pool (Reservoir at El. 416.55)

Length - 8,700 feet  
Area - 399 acres  
Volume - 13,500 acre-feet

Top of Dam (El. 425)

Length - 9,500 feet  
Area - 405 acres  
Volume 17,130 acre-feet

Maximum Pool (PMF - El. 425.5)

Length - 9,600 feet  
Area - 408 acres  
Volume - 17,460 acre-feet

d. Dam Data

Type - earth embankments  
Top Elevation - 425 feet (Dam No.1 and No.2)  
Original Ground Elevations - 378 feet (Dam No.1)  
402 feet (Dam No.2)  
Lengths - 1,340 feet (Dam No.1); 1,936 feet (Dam No.2)  
Top Widths - 25 feet (Dam No.1); 12 feet (Dam No.2)  
Side Slopes - upstream slope  $2\frac{1}{2}$ :1 (Dam No.1)  
upstream slope 2:1 (Dam No.1); downstream slope 2:1 (Dam No.1 and No.2)  
Zoning - none  
Impervious Core - rubble masonry: 10 feet wide at base narrowing to 4 feet at crest (Dam No. 1); 4 feet wide at base narrowing to 2.5 feet at crest (Dam No.2)  
Cutoff - base width of core extends into sound bedrock  
Grout Curtain - none

e. Engineering Data - The information available for review of Bog Brook Dam No. 1 and Dam No. 2 included:

- 1) Data Table - New York City Reservoirs
- 2) Excerpts from the "Report to the Aqueduct Commissioners, 1887-1895"
- 3) Excerpts from the "Report to the Aqueduct Commissioners, 1895-1907"
- 4) Profile of Flow Diagram for Croton System
- 5) Transverse Section Drawings of both Bog Brook Embankments
- 6) Plan of Dam No. 1 and Section Drawing of Outlet Gatehouse
- 7) Plan of Connecting Tunnel and Section Drawing of Connecting Tunnel Gatehouse
- 8) Elevation Drawing of Upstream Slope of Dam No.1 and Section Drawing of Outlet Works
- 9) Dam Report by the Conservation Commission, State of New York, dated August 6, 1915
- 10) "Report of a Structure Impounding Water", State of New York, Department of State Engineer and Surveyor

#### 1.4 OPERATING AND MAINTENANCE PROCEDURES

a. Operation - Two 30 inch drain pipes, operable for drawdown and low flow augmentation, are controlled by gate valves located in the outlet gatehouse and valve vault downstream of Dam No. 1. In addition, two gate valves and an emergency butterfly valve for control of discharge through the connecting tunnel to East Branch Reservoir are available for drawdown of Bog Brook Reservoir. According to Mr. John Birrell, Section Engineer, New York City Department of Environmental Protection, the valves are exercised every six months; and adjusted periodically to maintain a minimum conservation discharge of 5 million gallons per day. Reservoir elevation readings are taken daily.

b. Maintenance of Dam and Operating Facilities  
According to Mr. Birrell, maintenance is performed on a "most needed" basis.

c. Flood Warning System - According to Mr. Birrell, inspection crews are placed on round the clock duty during periods of high runoff. Reservoir levels are checked hourly, and high pool levels or unusual observations are reported to Mr. Birrell and the Deputy Chief Engineer. Mr. Birrell would contact local police and the Civil Defense for evacuation of downstream areas in the event of impending failure or overtopping.

## SECTION 2 - VISUAL INSPECTION

### 2.1 FINDINGS

a. General - The field inspection of the Bog Brook embankments took place on July 17, 1978. The reservoir water surface elevation was about 415 feet MSL during the inspection. No underwater areas were inspected.

b. Dam No. 1 - The riprap on the upstream face of the dam is a poorly graded mix of large, flat boulders (1 to 5 feet in diameter) and small rocks (6 inches or less in diameter). The boulders appear to have been individually selected and placed to maximize contact between adjacent stones while the cobbles were used as filler for the remaining voids. There is no visible vertical or horizontal displacement of the boulders but some of the cobble backfill near the water line has apparently been removed by wave action. Brush piles composed of small trees and bushes are scattered across the upstream face. This vegetation had apparently been cut down to root level shortly before the field inspection.

The dam crest, as well as the uppermost four feet of the upstream slope, is grass covered. Two long, shallow depressions were noted in the embankment crest: one immediately in front of the center gatehouse and another approximately 150 feet to the north. Each depression grades parallel to the long axis of the dam and reaches a maximum depth of about 18 inches. According to the operating personnel, these features have been noticeable for a period of years.

The entire downstream face of Dam No. 1 is covered with grass which is reported to be mowed about twice a year. No indications of settlement or slope misalignment were noted on the slope during the inspection. The toe drain extending from the southeast abutment to the center of the embankment is partially obscured by grass and brush growing amongst the cobble backfill. Some ponded water was noted in the drain during the inspection. Seepage was observed where the downstream slope of the embankment intersects the north slope of the stream valley. The ground surface, for about 20 yards to either side of the intersection and extending from the valley crest to the toe of the embankment is generally very moist and saturated in a few locations. Wheel ruts about 12 to 15 inches deep have been cut into the embankment and valley slopes in this area by the mowing equipment.

c. Dam No. 2 - The riprap protection on the upstream face of this embankment is similar to the riprap on Dam No. 1. The entire upstream slope and crest of the dam is heavily overgrown with small trees and brush. In addition to this vegetation, the downstream slope supports trees as tall as 50 feet. (Visual inspection of this structure was limited to walking a footpath along the dam crest, inspecting the upstream and downstream slopes at randomly selected locations and walking through the woods parallel to and below the downstream toe). Although no evidence of seepage or slope misalignments was evident, observations were severely limited due to dense vegetation.

d. Outlet Works - All of the original equipment inside the center outlet gatehouse, including the floor gratings, pulley hoists and supporting steel beams appear to be in fair condition. The sluice gate controlling the lowest inlet was completely opened at the time of inspection while the other gate was inoperable and scheduled for repairs. Both of the downstream stoplog slots were closed; spillage (about 30 gpm) into the southern outlet conduit was evident due to improper seating of the individual planks.

The tunnel gatehouse situated on the south abutment of Dam #1 also appears to be in fair condition. The butterfly valve located just upstream of the two sluice gates is inoperable, and according to the operator, the valve stem is rusted out with the valve in the open position. The two gate valves were not operated at the time of inspection.

The valve vault and tunnel housing for the outlet conduits appears to be in good condition. There was no evidence of flow in the tunnel at the time of inspection but some standing water (about 6 inches deep) was noted on the floor of the vault.

e. Stilling Basin and Downstream Channel - Extensive underwater plant growth was observed in the stilling pond and vines were seen growing between the rocks which form the walls of the basin. The cross-section of the stone lined channel downstream of the stilling basin appears uniform but is overgrown with weeds and brush. Flow from the stilling basin is conveyed through a 7 foot diameter culvert under a road located about 100 yards downstream of the dam.

f. Reservoir Area - The natural ground surrounding the reservoir has a moderate to steep slope and is well covered with trees and brush.

### SECTION 3 - HYDROLOGY/HYDRAULICS

According to the Recommended Guidelines for Safety Inspection of Dams, the Spillway Design Flood is the Probable Maximum Flood (PMF). The PMF was calculated from the 12 hour Probable Maximum Precipitation (PMP), using a loss rate of 0.1 inches per hour. The flood hydrograph was constructed from the Snyder unit hydrograph using average coefficients. Flood routing through the "Double Reservoir 1" was performed assuming the gated outlets to be closed, and the crest of the East Branch spillway to be at 425 feet MSL. The peak inflow and outflow rates were calculated as 58,000 cfs and 55,500 cfs respectively. The peak outflow corresponds to a stage of 9 feet above the spillway crest (0.5 feet above the top of dam). Peak inflow and outflow rates for one-half of the PMF were calculated as 29,000 cfs and 25,500 cfs respectively. The spillway capacity was calculated to be approximately 43,000 cfs. Although the spillway capacity is insufficient to pass the PMF, it will safely discharge at least one-half of the PMF, and is therefore not considered seriously inadequate, as cited in ETL 1110-2-234.

A drawdown analysis was performed assuming discharge from the two 36 inch pipes, the connecting tunnel closed, the starting water surface at the spillway crest, and 2 cfs per square mile inflow (7.5 cfs). According to the calculations, complete drawdown of the reservoir would take 30 days.

## SECTION 4 - STRUCTURAL STABILITY

### 4.1 VISUAL OBSERVATIONS AND DATA REVIEW

Two observations were made during the visual inspection of Dam No. 1 which suggest the existence of unstable conditions: The two long, narrow depressions in the dam crest indicate the possible loss of material from the embankment due to fines migration, and the saturated ground and seepage observed at the north abutment indicate that uncontrolled seepage path(s) have developed through the embankment or valley slopes.

The entire embankment of Dam No. 2 is overgrown with trees, brush and vegetation. The roots of the large trees on the slopes may be providing seepage paths which could lead to future piping. These trees could also be uprooted by high winds, which would result in the removal of a large volume of material from the embankment.

No design data was made available for either Bog Brook Dam No. 1 or No. 2.

### 4.2 GEOLOGY AND SEISMIC STABILITY

Bog Brook Reservoir is located in the New England Uplands physiographic province. The rocks in this province are either metamorphic or igneous, and the land forms show a close relationship to the relative durability of these rocks. Both of the Bog Brook embankments are founded upon metamorphic Precambrian hornblende gneiss and amphibolite. According to the discussion on Dam No. 1 in the "Report to the Aqueduct Commissioners, 1887-1895", the upper zone of this bedrock, was sic, "excavated to a considerable depth to avoid the percolation of water through its fissures." The apparent weathered condition of this rock necessitated excavations as deep as 50 feet below the original ground surface in an effort to encounter competent material on which to found the masonry corewall. Figure 8 of the Appendix shows a plot of the bottom of the corewall, the top of rock and the groundline along the center of Dam No. 1.

No fault zones or lineaments are known to exist in the vicinity of the dams or reservoir. The structures are located in Seismic Risk Zone 1 of the Seismic Zone Map of Contiguous States and it appears that static stability conditions are satisfactory.

## SECTION 5 - ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

### 5.1 ASSESSMENT

The depressions in the crest of Dam No. 1 may be indicative of fines migration through the embankment although no evidence of seepage or misalignments was noted on the downstream slopes immediately below the depressions. Surface erosion does not appear to be the cause of the depressions since the ground surface is uniform and there is no standing water or excessive moisture at the low points. The operating personnel stated that these features have remained unchanged for at least eight years.

According to Mr. Birrell, Section Engineer, the seepage and saturated ground at the north abutment of Dam No. 1 has existed for a number of years except during extended periods of dry weather. Fine-grained soil is not in evidence either in the seepage or as accumulated deposits on the dam and valley slopes. The "Report to the Aqueduct Commissioners, 1895-1907" states, sic "notwithstanding that precaution (extending the corewall into what was considered competent bedrock), a slight infiltration occurs, which has been collected in a system of drains and led finally through small pipes, where its volume can be constantly observed." The location of these pipes is unknown and it is possible that the observed seepage is a result of a clogged drain system.

The root systems of the trees and brush growing on Dam No. 2 may have a deleterious affect upon the compacted materials in the embankment and provide seepage paths which could lead to future piping and failure of the structure. In addition, high winds could uproot the trees and remove large portions of the embankment.

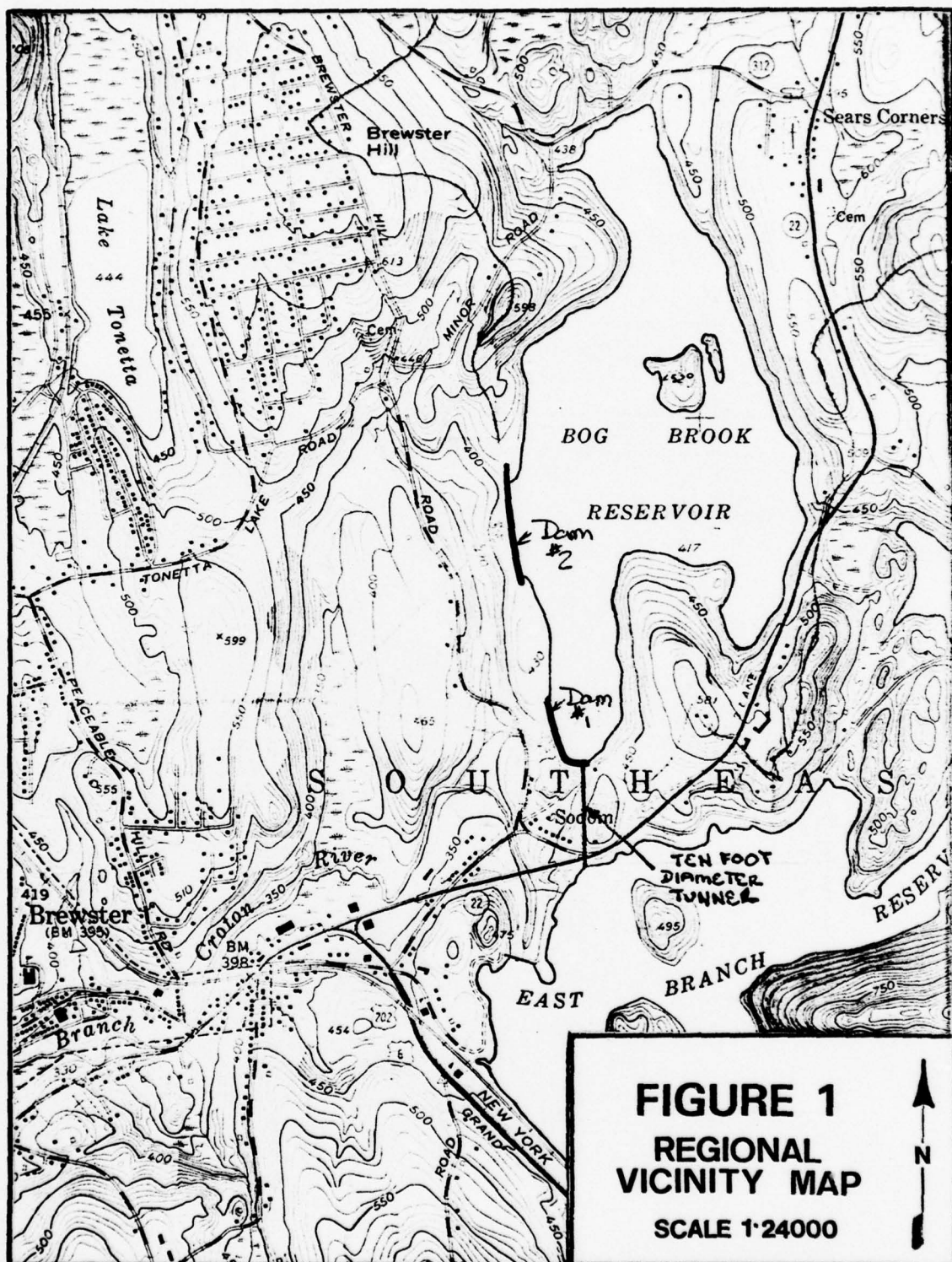
Results of the hydrologic/hydraulic analysis indicate that the dams could be overtopped by all floods exceeding approximately 83 per cent of the Probable Maximum Flood. The East Branch spillway is hydraulically inadequate to pass flood flows associated with the PMF; however, the spillway is not considered "seriously inadequate" as cited in Engineering Technical Letter No. 1110-2-234, May 10, 1978.

## 5.2 RECOMMENDATIONS/REMEDIAL MEASURES

A boring program should be initiated at several sections (including the depressed areas) of the embankment to include, but not be limited to, determination of the composition and in-situ properties of the embankment and foundation materials to establish if they are satisfactory for the embankment, corewall and foundation as designed and constructed; to assist in the determination of the cause of the seepage and to detect possible fines migration. The results of these investigations should be used to perform seepage and stability analyses for the embankment.

The inoperable valves in the connecting tunnel gatehouse and the outlet gatehouse should be repaired. The trees and brush growing on Dam No. 2 should be cut near the ground surface and an investigation made to determine the extent of the root systems before additional measures are undertaken. The toe drainage ditch for both structures should be cleared of debris and vegetation to insure proper collection of runoff and seepage.

FIGURES



# CROTON SYSTEM

DATA

Name of Reservoir	Location		Drainage Area		Date	Type
	Town	County	Sq Mi	Includes Items		
1 BOYDS CORNERS	KENT	PUTNAM	25.46	1	1873	MASONRY, EARTH
2 BARRETTS POND	"	"	55	2	1873	EARTH
3 LAKE GLENSIDE	CARMEL	"	0.60	3	1870	EARTH
4 WEST BRANCH (Carmel)	"	"	42.67	1/0.4	1895	EARTH, MASONRY
5 WEST BRANCH	"	"	"	"	"	"
6 MIDDLE BRANCH	SOUTHEAST	"	21.51	5	1870	EARTH, MASONRY
7 BOG BROOK	"	"	3.67	6	1892	"
8 EAST BRANCH (SODOM)	"	"	80.20	6.67	1891	MASONRY, EARTH
9 CROTON FALLS (DIVERTING)	"	"	87.56	6/0.8	1911	EARTH, CONCRETE
10 LAKE GILEAD	CARMEL	"	0.87	9	1870	EARTH
11 CROTON FALLS	"	"	168.64	1, 5, 9, 10	1911	CYCLOPEAN MASONRY
12 LAKE KIRK	"	"	7.84	11	1870	EARTH
13 AMARYNKA	SOMERS - WESTCHESTER	"	19.13	10/0.2	1897	EARTH, MASONRY
14 TITICUS	NORTH SALEM	"	25.33	13	1893	MASONRY, EARTH
15 CROSS RIVER	BEDFORD	"	29.80	14	1906	CYCLOPEAN MASONRY
16 MUSCOON	SOMERS & BEDFORD	"	51.73	10/0.13	1905	MASONRY
17 NEW CROTON	CORTLAND	"	375.00	1/0.16	1905	MASONRY
x Control 59 Lakes			CROTON TOTALS			

# CATSKILL SYSTEM

1 ASHOKAN	OLIVE BROOK - ULSTER	257.00	1	1905	MASONRY
2 SCHOMARIE	GILBOA - GREEVE	34.00	2	1906	MASONRY
CATSKILL TOTALS					

# DELAWARE SYSTEM

1 NEVERSINK	NEVERSINK SULLIVAN	93.0	1	1933	EARTH, CONCRETE
2 DEPACTION	COCHESSETOWN DELAWARE	372.0	2	1934	"
3 CANNONVILLE	DEPOSIT, TOWN OF DELAWARE	4500	3	1967	ROLLED
4 RONDOUT	NARROWS, ULSTER	95.00	1/0.4	1931	CONCRETE
DELAWARE TOTALS					

# KENSICO RESERVOIR

KENSICO	VT. DELAWARE - WESTCHESTER	13.33	1	1905	MASONRY
---------	----------------------------	-------	---	------	---------

# PERTAINING TO N.Y. CITY RESERVOIRS

THE IMPOUNDING RESERVOIRS BELONG TO THE  
OPERATING LEVEL & 568.0 BILL GAL. (AVAILABLE)

of Dam	Capacity (Bill. Gal.)		Area of water surface of Spillway Elev.		Length of Spillway Mils	Elev. of Spillway M.S.L. Sandy Hook Feet	Elev. of H. of Max. Dept. (Min. Oper. Level) Feet	Elev. of Sill or Outlet Feet	Depth of Spillway to Outlet Feet
	Total Avail-able (Above Sill or Outlet)	Min. Dept. Above Min. Op. Level	Sq. Mils.	Acres					
135	1.696		0.464	295.9	6.2	560.05		536.7	43.4
	0.170		0.106	67.1	1.4	778.55		768.6	10.0
	0.163		0.264	168.9	2.2	504.53		499.6	5.0
ORE & SPILLWAY	10.070		1.092	1062.8	15.6	503.2		435.6	47.0
						514.55 Top		466.1	
ORE	4.003		0.609	426.2	6.82	371.55		310.5	61.1
	4.400		0.640	399.0	4.9	416.53		363.1	51.5
135	5.243		0.698	536.8	10.5	416.53		331.0	65.0
CORE & SPILLWAY	0.888		0.240	153.6	4.2	309.53		275.8	33.8
	0.380		0.191	122.2	2.1	496.53		460.6	16.0
URY	14.192		1.660	1062.4	18.0	309.4		214.8	95.0
	0.565		0.158	101.1	3.1	502.53		504.8	16.0
ORE	6.692		0.947	606.1	8.5	399.53		334.6	65.0
INGS WITH MASONRY CORE	7.167		1.046	664.4	8.1	324.3		249.8	75.0
MURY, CONCRETE FACES	10.308		1.202	764.2	12.9	329.53		224.6	105.0
	4.914		1.822	1166.1	35.0	190.53		164.6	30.0
	23.782		3.330	2259.2	38.0	195.53		134.6	36.0
	94.637	86.6	13.531	9911.0	177.52				

	127.858	122.9	12.99	8315.2	40.2	840.53	UNKNOWN	368.88	37.73	4.
	19.583	17.3	1.79	1145.0	16.5	1130.0	"	1050.0	80.00	
	147.441	140.5	14.73	9460.2	56.5					

CORE	35.466	34.9	2.3	1470	16.5	1440.00	1319.03	1314.00	126.00	1.
"	143.701	140.2	8.9	5700	53.5	1250.00	1152.00	1143.00	137.00	6.
FILL	96.726	95.7	7.5	4800	53.5	1150.00	1040.00	1035.00	115.00	1.8
						1150.00				
CORE	50.048	49.6	3.25	2030	17.0	840.00	723.00	720.00	120.00	2.3
	325.941	320.4	21.95	14030	140.5	GLOW WEIR				
						DNIGH "				

SAFETY OR INTERMEDIATE STORAGE RES FOR ALL OF THE CITY'S & DELAWARE SUPPLIES ALL

	30.573	UNKNOWN	3.47	2210.3	30.0	357.00	UNKNOWN	295.32	61.63	UN
--	--------	---------	------	--------	------	--------	---------	--------	-------	----

CROTON, CATSKILL & DELAWARE SYSTEMS TOTTALLING 547.5 B/L. GAL. ABOVE MIN.  
 LE ABOVE SILL. AN ADDITIONAL 30.6 BILL GAL. IS STORED IN A SAFETY STORAGE RES. KENSICO

Dead Storage Million Gallons	Length of Spillway Feet	Max Depth Below Spillway Feet	Max Hgt of Main Dam		Width of Dam Feet		Length of Dam Feet	
			Above Lowest Foundation Feet	Above NAT.C Surface Feet	Top	Bot.	Total	Masonry Portion
	135.0		78.0	57.0	6.60	53.60	670.0	670.0
UNKNOWN	260.0	UNKNOWN	66.0	62.0	19.00	307.50	1794.5	260.0
	AC 3% WY		65.0	50.0	23.00	240.00	741.0	
	100.0		99.0		50.00	660.00	615.0	100.0
			115.8	53.8	73.88	773.38	1353.8	
	500.0		96.0	76.0	12.00	53.00	1100.0	500.0
	1000.0		51.0	45.0	15.00	240.00	2190.0	1000.0
	700.0		173.0	113.0	23.00	116.00	1300.0	1100.0
	50.0			62.0	55.00	656.00	1270.0	50.0
	200.0		135.0	104.0	25.70	75.21	1519.0	200.0
	240.0		170.0	126.0	23.00	116.30	1060.0	640.0
	950.0		56.0		4.00	40.00	1150.0	1133.0
	1000.0		297.0	174.0	16.00	206.00	2165.0	2165.0

# REMARKS

Most of the Croton  
 carried by the New  
 Aqueduct

0.137	950.0	150.0	252.0	210.0	26.93	200.00	4650.0	1000.0
	1524.0	150.0	182.0	155.0	15.00	156.00	2260.0	2000.0

Schoharie water is  
 Tunnel to Adirondack  
 enter the Catskill Aq

600	600.0	175.00	345.0	195.0	60.00	1392.00	2620.0	NONE
1000	600.0	160.00	304.0	204.0	60.00	1460.00	2450.0	"
892	3 240.0	76.00	196.0	179.0	45.00	1312.00	2600.0	"
	560.0	95.00						
367	600.0	175.00	375.0	195.0	60.00	1392.00	2400.0	"

Neversink, Pepacton  
 are conveyed via the  
 & W. Delaware Tunnel  
 Thence all Four su

30 SOME OF THE CROTON SUPPLY (SEE REMARKS).

KNOW	50.0	155.50	307.0	165.0	23.00	235.00	1643.0	1643.0
------	------	--------	-------	-------	-------	--------	--------	--------

Of the Croton Supply  
 plus pumpage from  
 Falls flows into the

unmarked  
me

Camp J.J.D.  
Grown J.R.D.

Supply is  
Croton

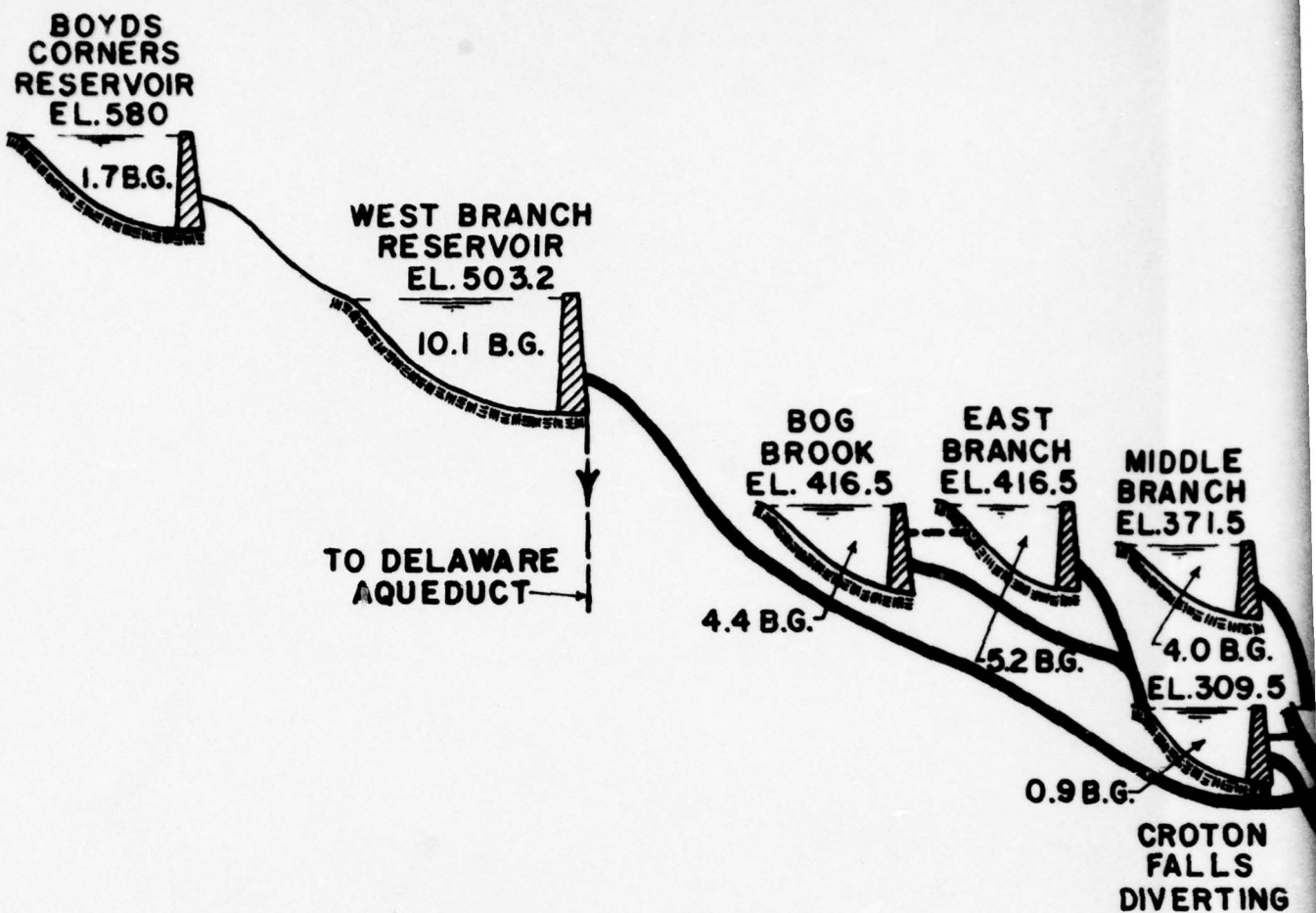
conveyed by the Shandaken  
s. Thence both supplies  
educt.

& Cannonsville supplies  
Neversink, East Delaware  
to the Rondout Res.  
plies enter the Del. Aqueduct.

## FIGURE 2

all of the West Branch  
Cross River & Croton  
ico Reservoir.

Acc NS



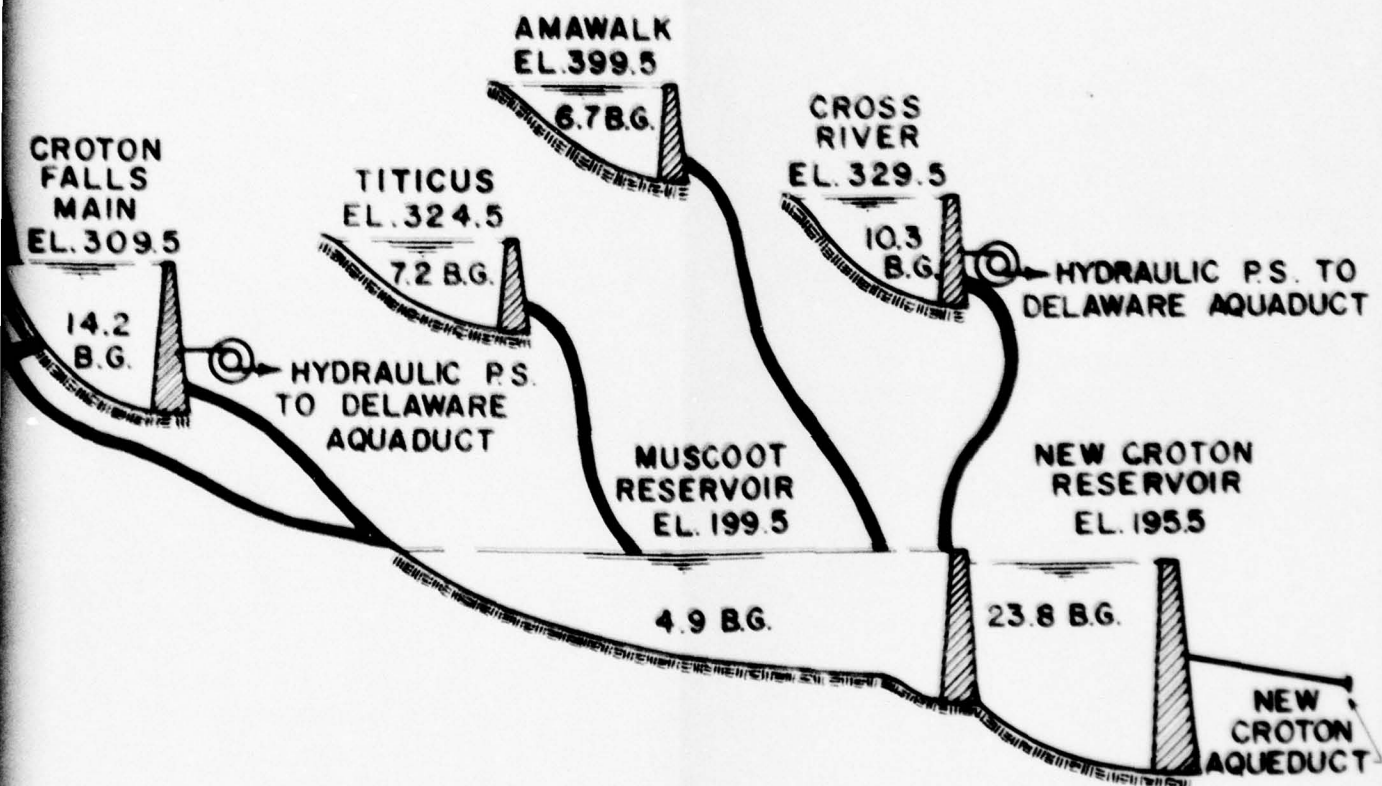
#### LEGEND

-  = NATURAL WATER COURSE.
-  = TUNNEL AQUEDUCT.
-  = GRADE AQUEDUCT.

#### NOTE

ELEVATIONS OF RESERVOIRS ARE AT MASONRY CREST OF SPILLWAY.  
FIGURES SHOWN IN RESERVOIRS ARE CAPACITIES IN BILLION GALLONS.

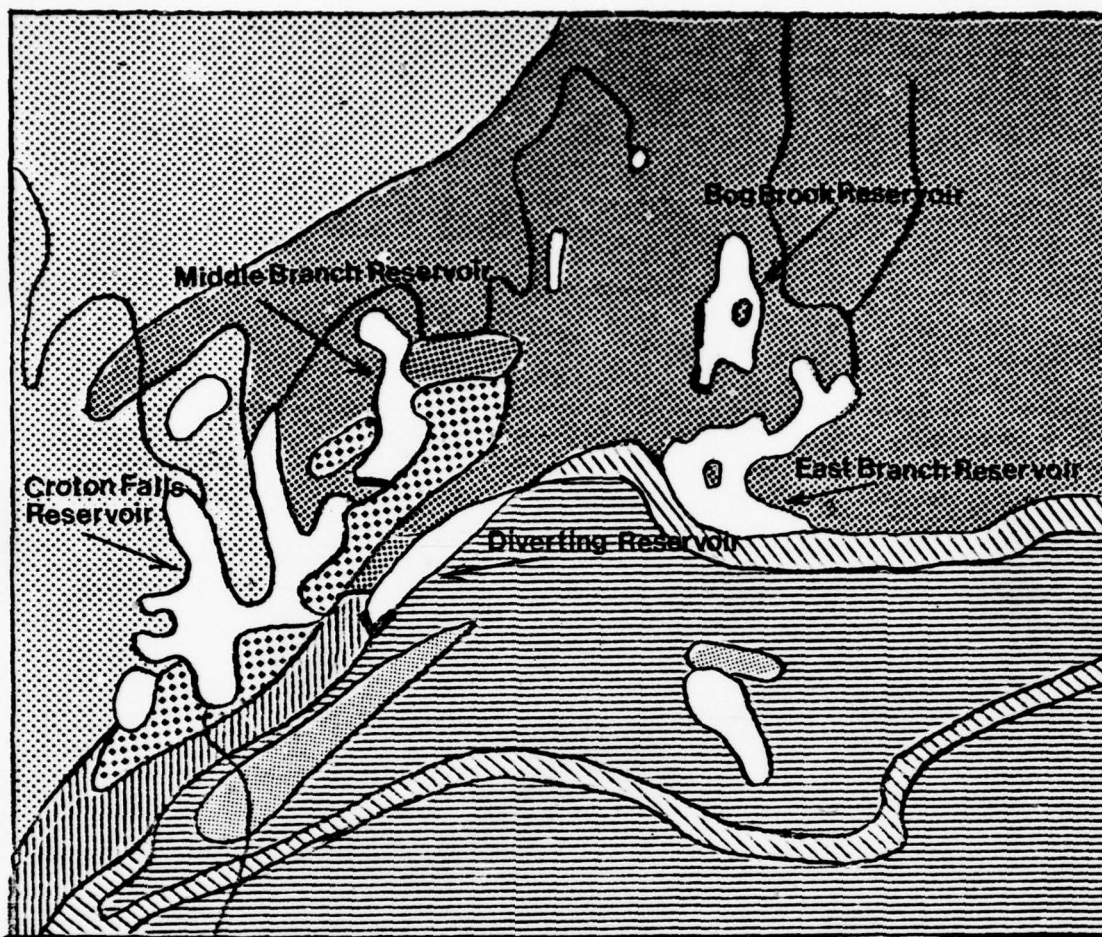
ELEVATIONS REFER TO M.S.L. SANDY HOOK.



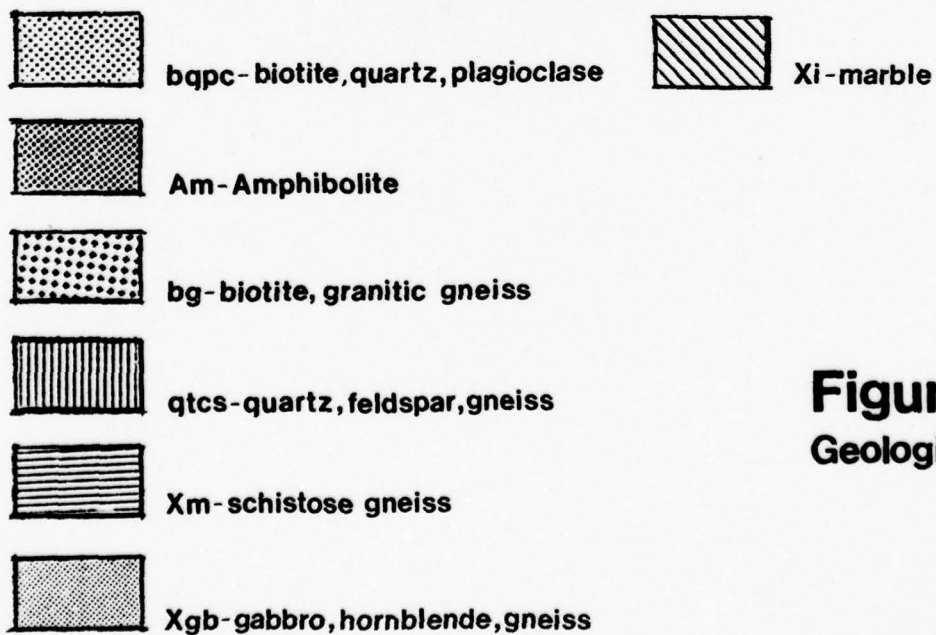
CITY OF NEW YORK  
BUREAU OF WATER SUPPLY  
PROFILE OF FLOW DIAGRAM FOR  
CROTON SYSTEM

FIGURE 3

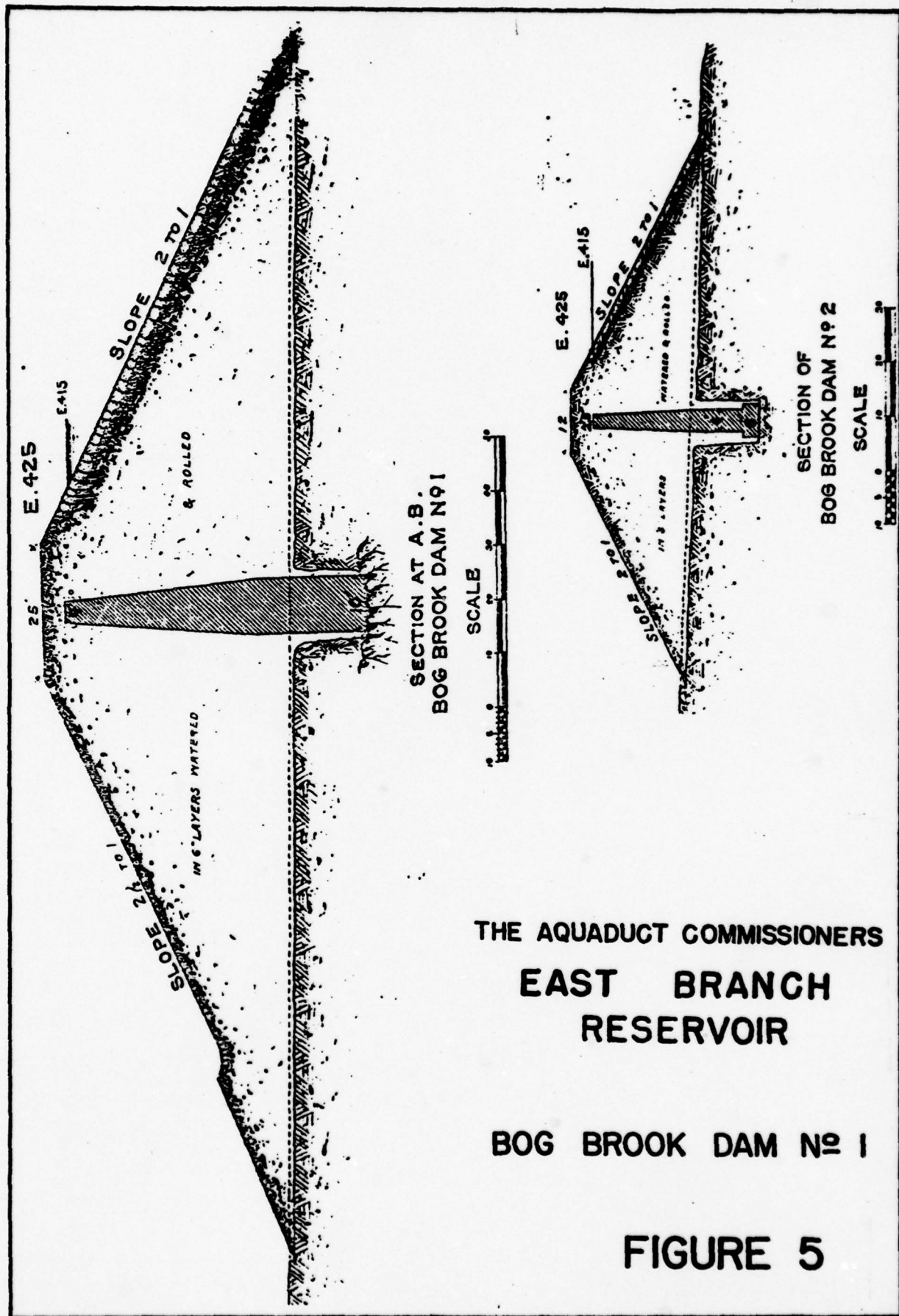
2

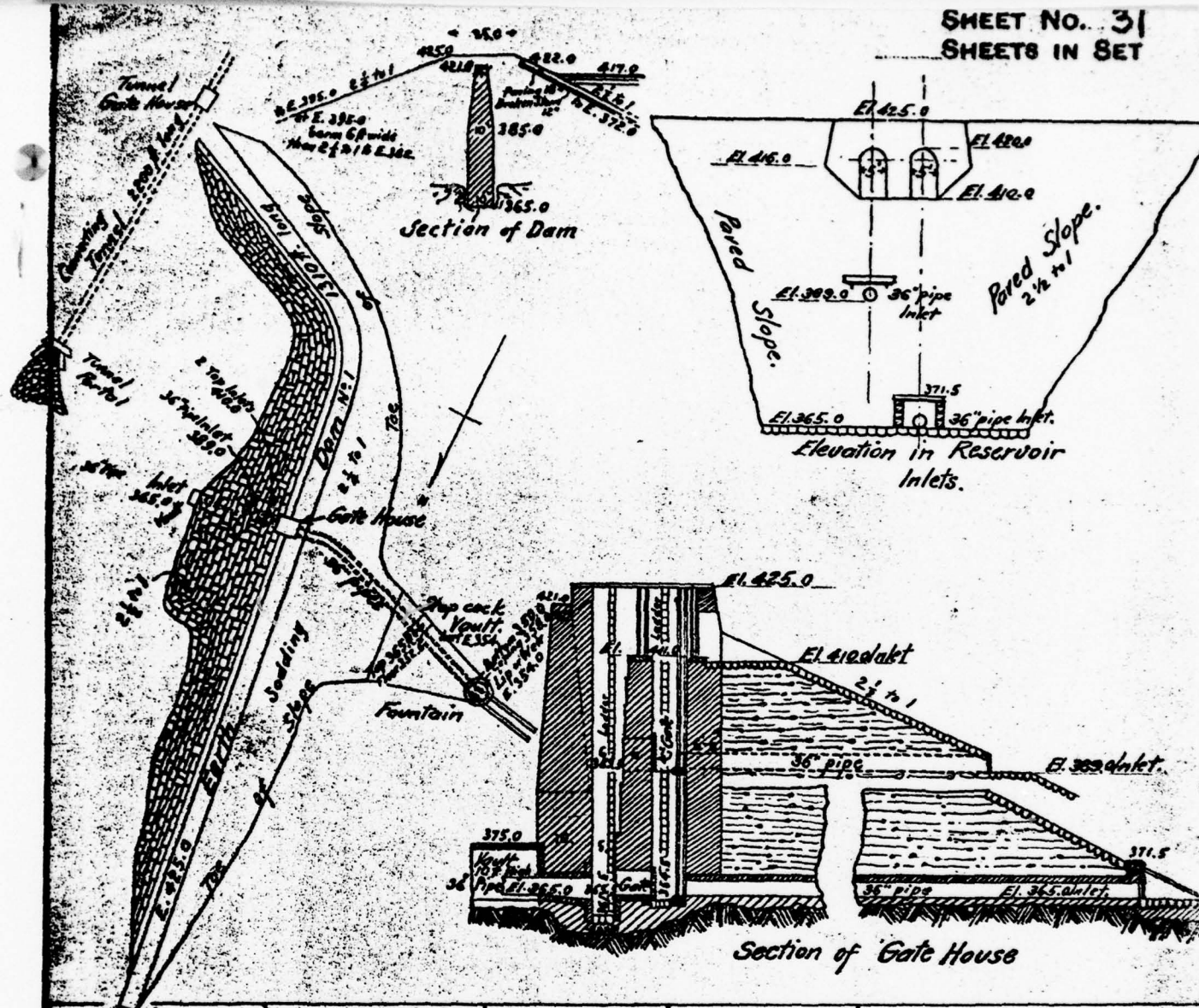






Scale: 1 inch = 1.7 miles



**Figure 4**  
Geologic Map





Inlets			Outlets		Gates		Stop-cocks			Remarks-		
Number	Shape and Dimension	Elevation of Invert	Number	Shape and Dimension	Elevation of Invert	Number	Size	Elevation of Invert	Number	Diam.	Elevation of Invert	
2		410.	2	 pipes	354	1	2'x5'	389.5	2	36"	354.	No Spillway Elev. lip of Fountain 354. Earth Dam N°2 is 1935 ft. long.
1	 Pipes	389										
1		365.										

**CITY OF NEW YORK**  
**THE AQUEDUCT COMMISSIONERS**

DOUBLE ENTRANCE " "

**CITY OF NEW YORK**  
**THE AQUEDUCT COMMISSIONERS**

DOUBLE RESERVOIR  
BOG BROOK

EARTH DAM NO 1.  
ACCESSION NO.

Drawn by **A.S.F.**  
Titled **W.E.K.**  
Designed by **W.E.K. & J.P.G.**

## FIGURE 6

Inlets.			Outlets			Gate	Sewer cocks	Remarks.
Num.	Shape and Dimension	Elevation of Invert.	Num.	Shape and Dimension	Elevation of Invert.			
1.	At Portal 10'	380.	1.	Same as Inlets.	380.			NOTE: These Elevations refer to Croton Datum which is 3.61 ft below City Datum.
1.	At Gate House 7'	380.	1.		380.			

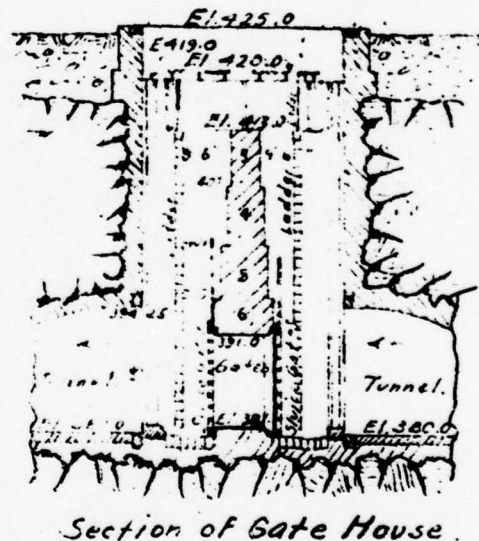
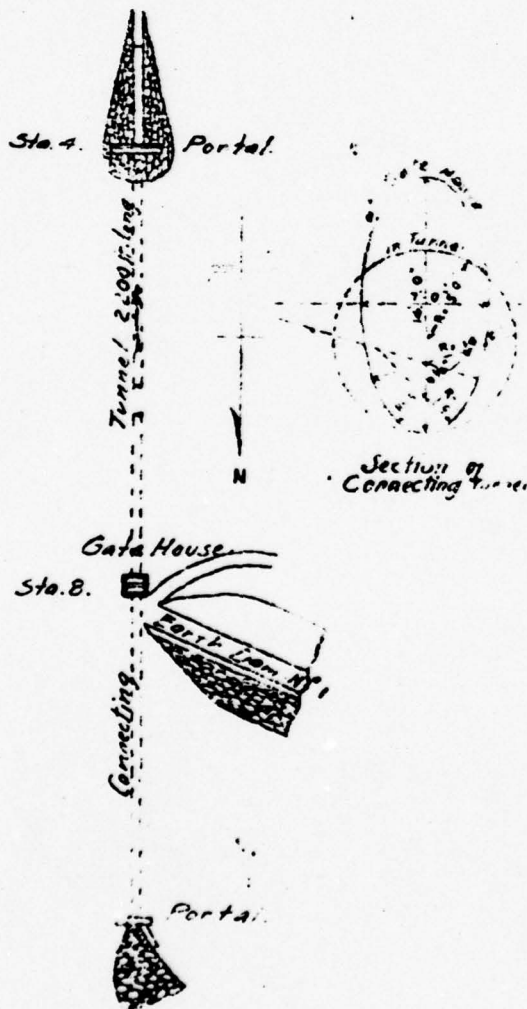
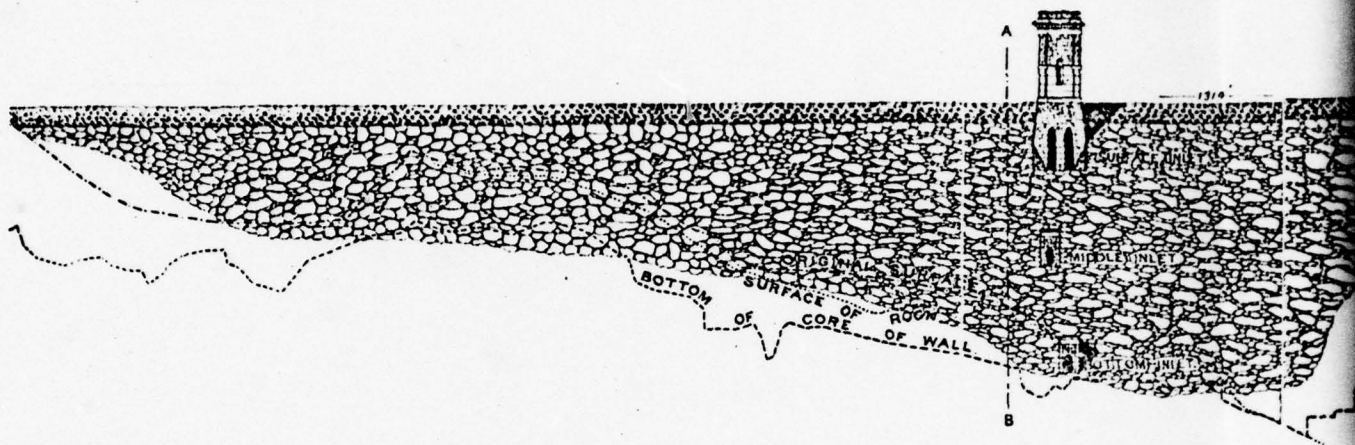


FIGURE 7

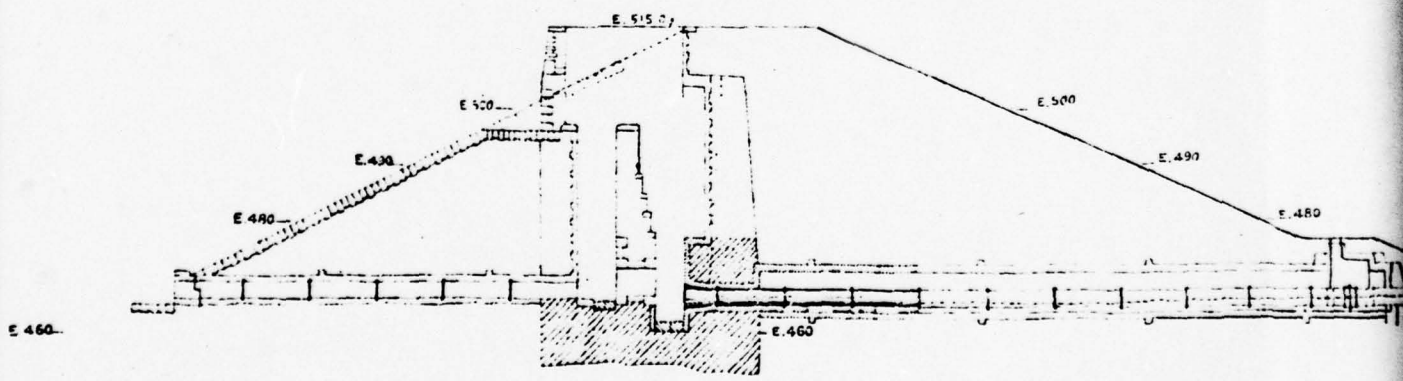
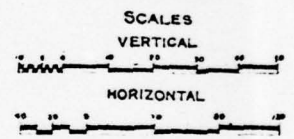
CITY OF NEW YORK  
THE ALUEDUCT COMMISSIONERS  
Bog Brook  
DOUBLE RESERVOIR "I"  
CONNECTING TUNNEL  
& GATE HOUSE

Drawn by... A.S.F.  
Traced by... A.W.F.  
Checked by A.W.F. & W.E.K.: 8

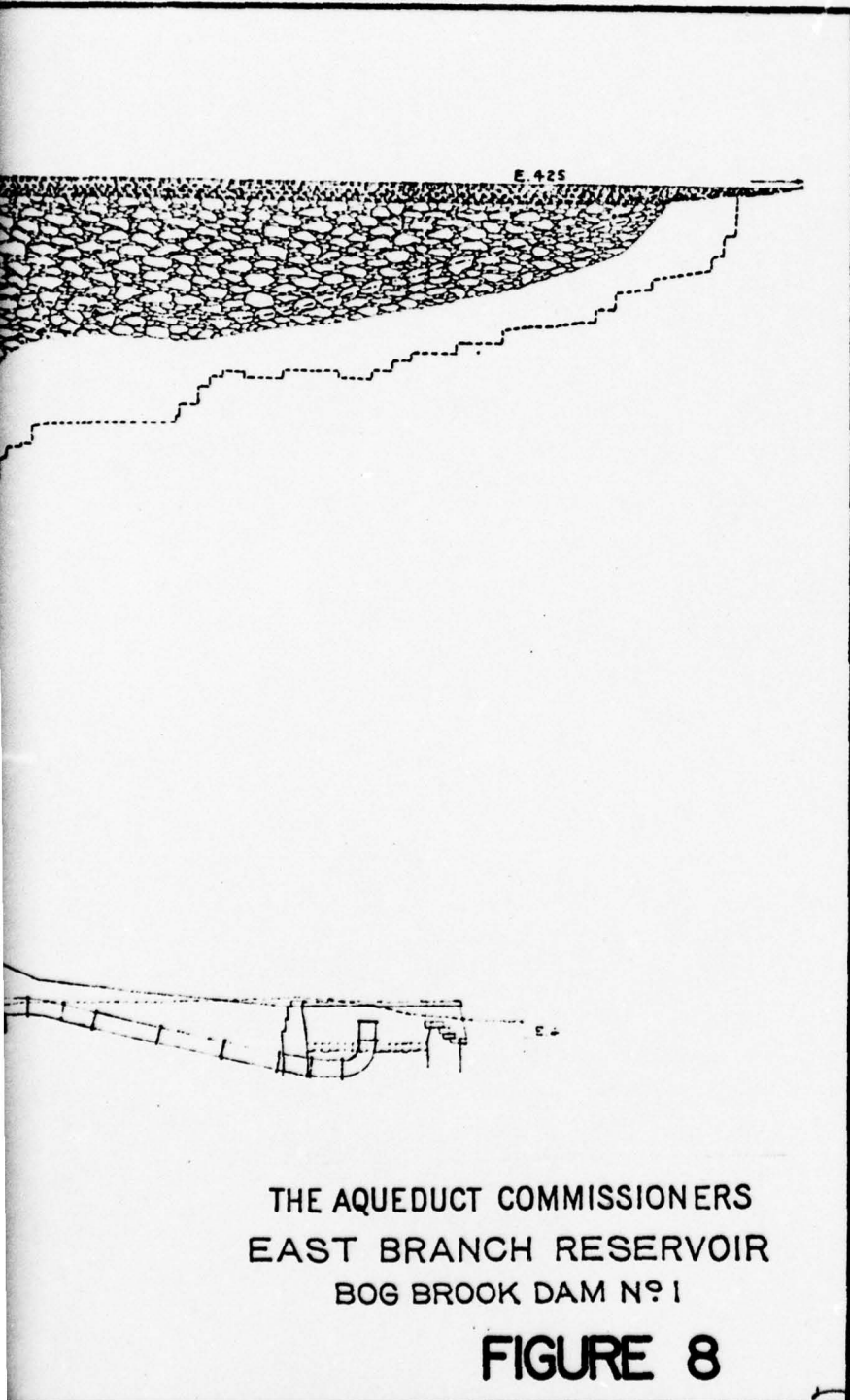
SECTION NO.



# ELEVATION



# SECTION AT GATE HOUSE



2

APPENDIX

PHOTOGRAPHS



SATURATED GROUND NEAR RIGHT ABUTMENT  
OF DAM NO. 1



CREST OF DAM NO. 2

FIELD INSPECTION REPORT

Name Dam	County Putnam	State New York	Coordinators
Bog Brook Dam No. 1			
Bog Brook Dam No. 2			

Date(s)	Inspection	July 17, 1978	Weather	Overcast	Temperature	75°
---------	------------	---------------	---------	----------	-------------	-----

Pool Elevation at Time of Inspection	417	M.S.L.	Tailwater at Time of Inspection	-----	M.S.L.

**Inspection Personnel:**

Mr. George Elias	
Mr. David Campbell	
Mr. Steve Snider	

Mr. Steve Snider \_\_\_\_\_ Recorder

Accompanied by:

Mr. John Birrell - Section Engineer, New York City Department of Environmental Protection  
Mr. Edward Stoorza - Section Foreman, New York City Department of Environmental Protection

# EMBANKMENT

## REMARKS OR RECOMMENDATIONS

### OBSERVATIONS

### VISUAL EXAMINATION OF

#### SURFACE CRACKS

None noted.

None.

#### UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE

None noted.

None.

#### SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES

A-2

None noted on Dam No. 1.  
Dense vegetation on Dam No. 2.  
obstructed visual detection of  
this condition.

All growth on Dam No. 2  
should be removed.

#### VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST

Two long, shallow depressions  
noted in the crest on Dam No. 1.

A study should be made to  
determine their cause and if  
they are increasing in size.

#### RIPRAP FAILURES

Some minor loss of cobble backfill  
noted at the waterline on Dam No. 1.  
Dense vegetation on Dam No. 2  
obstructed visual detection of this  
condition.

All growth on Dam No. 2  
should be removed.

# EMBANKMENT

## REMARKS OR RECOMMENDATIONS

## OBSERVATIONS

## VISUAL EXAMINATION OF

JUNCTION OF EMBANKMENT  
AND ABUTMENT, SPILLWAY  
AND DAM

Seepage noted at the north abutment  
of Dam No. 1. Ground surface was  
moist and saturated in some  
locations.

A study should be undertaken to  
determine the cause and source  
of seepage and it should be  
monitored continuously to  
detect turbidity or increased  
flow.

ANY NOTICEABLE SEEPAGE

A-3

See above.

See above.

STAFF GAGE AND RECORDER

N/A

DRAINS

The two drains for both dams  
are partially filled with  
vegetation and debris.

The drains should be cleaned  
to insure proper collection  
of runoff and seepage.

# OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None noted.	None.
INTAKE STRUCTURE	Emergency butterfly valve inoperable at time of inspection.	Repair valve.
OUTLET STRUCTURE  A-4	One of the gate valves was inoperable at time of inspection. Stop logs in down- stream slot of middle inlet were not properly seated allowing about 30 gpm to pass into outlet conduit.	Repair gate valve.
OUTLET CHANNEL	Some grass and brush growing from stone walls of stilling pond.	None.
EMERGENCY GATE	See "Outlet Structure"	

RESERVOIR

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION OF

SLOPES

No problems noted.

None.

SEDIMENTATION

None noted.

None.

# DOWNSTREAM CHANNEL

## REMARKS OR RECOMMENDATIONS

## OBSERVATIONS

## VISUAL EXAMINATION OF

### CONDITION

(OBSTRUCTIONS,  
DEBRIS, ETC.)

No problems noted.

None.

### SLOPES

Slopes of channel heavily overgrown  
with brush and some small trees.

None.

### APPROXIMATE NO. OF HOMES AND POPULATION

The Village of Brewster, New York, is  
located within 1½ miles of both dams.  
The population is approximately 1,600  
(800 homes).

None.

ITEM	REMARKS
------	---------

MONITORING SYSTEMS

Personnel from the New York City Department of Environmental Protection operate and monitor operation of the reservoir.

MODIFICATIONS

None.

HIGH POOL RECORDS

Maximum pool of record was 419.15 feet MSL recorded on October 16, 1955.

POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS

None noted.

A-7

PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS

None noted.

MAINTENANCE OPERATION RECORDS

None available.

# ITEM REMARKS

DESIGN REPORTS

Two reports entitled "Report to the Aqueduct Commissioners, 1887-1895 and 1895-1907" contain brief discussions pertinent to the purpose, operation and construction of the Bog Brook Dams and appurtenances.

GEOLOGY REPORTS

None available.

DESIGN COMPUTATIONS  
HYDROLOGY & HYDRAULICS  
DAM STABILITY  
SEEPAGE STUDIES

None available.

A  
8

MATERIALS INVESTIGATIONS  
BORING RECORDS  
LABORATORY  
FIELD

None available.

POST-CONSTRUCTION SURVEYS OF DAM

None available.

BORROW SOURCES.

Unknown.

.....  
HYDROLOGIC AND HYDRAULIC COMPUTATIONS

DATE 8/2/78

NAME OF CLIENT NYSDEC

COMP. BY DSC

PROJECT Bog Brook Reservoir

CHECKED BY REH

Bog Brook Reservoir & East Branch Reservoir are connected by a 10' diameter tunnel, and the spillway @ East Branch provides for outflow from both reservoirs.

Total drainage area = 80.28 square miles

$L = 19$  miles       $LCA = 8$  miles

$$t_p = C_t (L \times LCA)^{.3} = 2.0 (19 \times 8)^{.3} = 9.0 \text{ hrs}$$

$$t_R = t_p / 5.5 = 1.6 \text{ hrs.} \quad \text{use } t_R = 1.5 \text{ hrs.}$$

Spillway crest at East Branch = 416.55 ft MSL  
Spillway length = 500'

Surface area of reservoirs @ normal pool = 956 acres

Surface area @ El. 420 = 1225 acres

Assume area a linear function of elevation above the crest.

$$A = 78H + 956 \quad \text{\& Supcharge Storage } (S) = \int (78H + 956)$$

$$S = 39H^2 + 956H + C$$

NAME OF CLIENT NYSDEC

COMP. BY DBC

PROJECT Bag Brook Reservoir

CHECKED BY REH

## Stage - Storage Relation

Elevation	H (ft)	S (acre-ft)
416.55	0	0
418.0	1.45	1468
420.0	3.45	3762
421.0	4.45	5026
422.0	5.45	6369
423.0	6.45	7789
424.0	7.45	9287
425.0	8.45	10863
426.0	9.45	12516
427.0	10.45	14249

## Stage - discharge relation

Spillway -  $Q_s = 3.5 \times 500 \times H^{3/2}$

Top of dam @ El 425  $Q_{OT} = 3.1 \times 3300 \times (H - 8.45)^{3/2}$

Elevation	H	$Q_s$	$Q_{OT}$	$Q_T$
416.55	0	0	0	0
418.00	1.45	3056	0	3056
420.00	3.45	11214	0	11214
421.00	4.45	16428	0	16428
422.00	5.45	22266	0	22266
423.00	6.45	28667	0	28667
424.00	7.45	35585	0	35585
425.00	8.45	42986	0	42986
426.00	9.45	50837	10230	61067
427.00	10.45	59117	28935	88052

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PHILADELPHIA, PA

SHEET NO. 3 of 6

DATE 8/2/78

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NAME OF CLIENT NYSDEC

PROJECT Bag Brook Reservoir

$$6 \text{ HR. PMP} = 24''$$

Reduction for "probable misfit" of storm  
isohyets and drainage basin = 148

$$6 \text{ HR PMP}_{\text{REDUCED}} = 20.64''$$

$$\text{ZONE 1, 80 sq. miles} \quad 6 \text{ HR PMP} = 20.64'' \times .77 = 15.9$$

Time	$\Sigma$	$\Delta$
0	0	0
1.5	9.0	9.0
3.0	12.1	3.1
4.5	14.1	2.0
6.0	15.9	1.8
7.5	$12 \text{ HR PMP} = 20.64 \times .89$ $= 18.4$	.7
9.0		.7
10.5		.6
12.0	$12 \text{ HR} - 6 \text{ HR} = 2.5''$	.5

Third quartile  
arrangement

.5

.6

1.8

2.0

3.1

9.0

.7

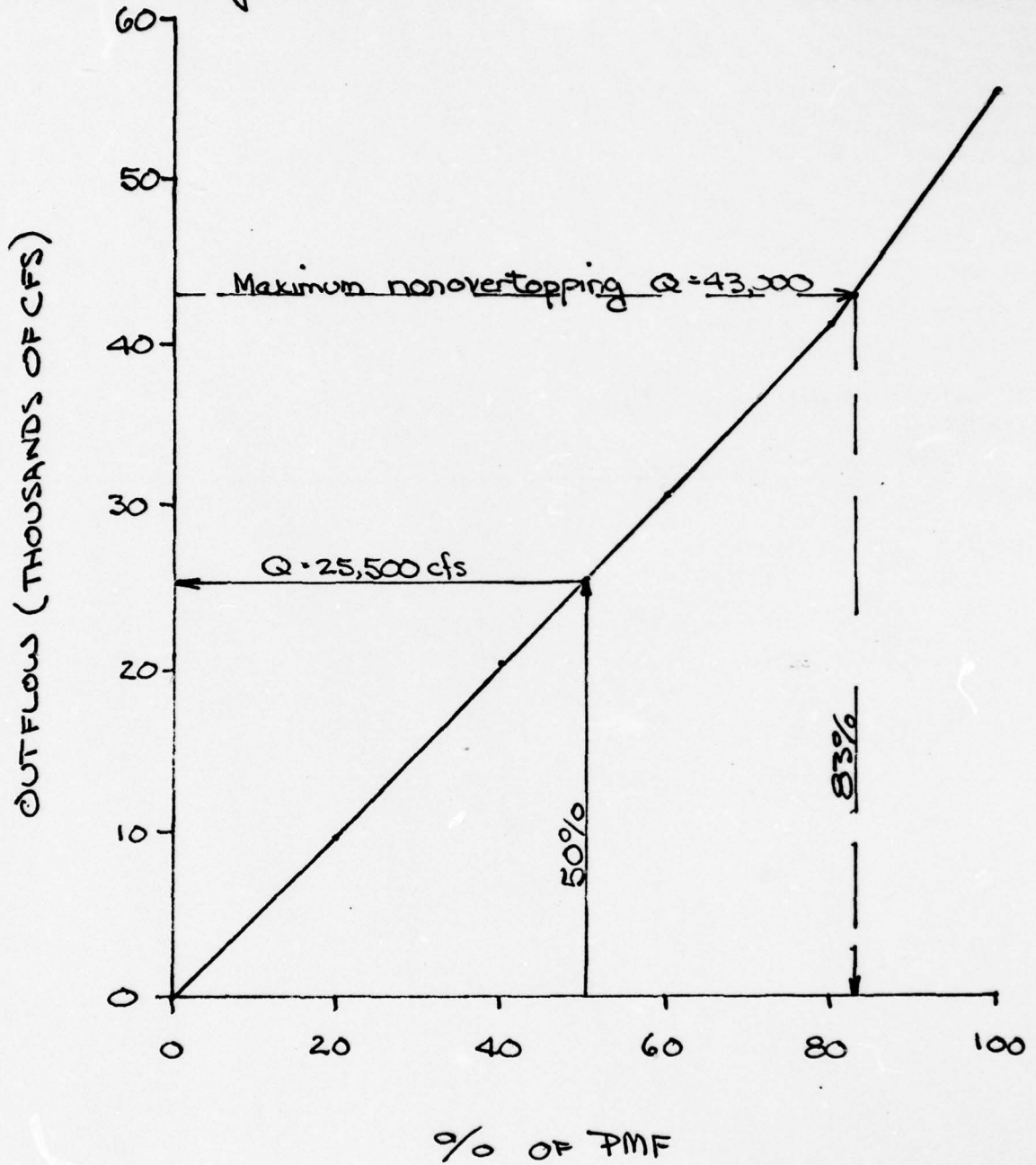
.7

JUSTIN & COURTNEY, INC.  
Division of O'Brien & Gere Engineers, Inc.  
PHILADELPHIA, PA

SHEET NO. 4 OF 6  
DATE 9/7/78  
COMP. BY DBC  
CHECKED BY REL

NAME OF CLIENT NYSDEC

PROJECT Bag Brook



NAME OF CLIENT NYSDEC

PROJECT Bog Brook Dam

## Drawdown Computations

Outlet Discharge (tunnel assumed closed)

$$H = \left( 1 + K_e + K_v + K_s + \frac{29n^2L}{r^{4/3}} \right) \frac{V^2}{2g}$$

$K_e$  = entrance and exit losses

$K_v$  = valve loss

$K_s$  = sluice loss

$$n = .025 \quad L = 450' \quad \& \frac{V^2}{2g} = \frac{Q^2}{2gA^2}$$

$$H = \left( 1 + 1.5 + .5 + .25 + \frac{29(.025)^2 450}{.75^{4/3}} \right) \frac{Q^2}{2g(\pi 1.5^2)^2}$$

$$H = \frac{(7.56) Q^2}{3217.7} = .00235 Q^2$$

$$\therefore Q = 20.63 H^{.5} \text{ (per pipe)} \quad Q_T = 41.26 H^{.5}$$

Assume an inflow of 2 c.f.s./sq. mi.  $\times$  3.67 sq. mi. = 7.5 cfs

$$\therefore Q_{NET} = 41.26 H^{.5} - 7.5 \quad \begin{array}{l} \text{Assume } T_w = 356.6 \\ \text{(Lip of stilling basin weir 354.6)} \end{array}$$

H	55	45	35	25	15
Q	298	269	237	199	152

NAME OF CLIENT NYSDEC  
PROJECT Boag Brook

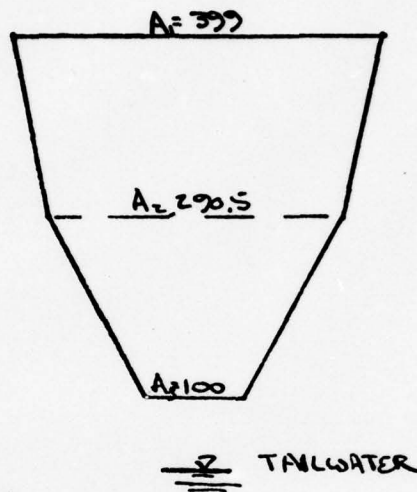
Normal pool volume = 13500 acre-feet  
Depth normal pool to lower outlet invert = 50'  
Surface area = 399.0 acres  
Assume Area at lower outlet invert = 100 acres

$$V = 13500 \text{ acre-ft}$$

$$= \frac{399 + A_2}{2} \times 25 +$$

$$\frac{A_2 + 100}{2} \times 25$$

$$A_2 = 290.5 \text{ acres}$$



$\Delta H$	$H_{AVE}$	$A_{AVE}$	$\Delta S$	$Q_{INSTAKE}$	$\Delta T (HRS)$	$\Sigma T (DAYS)$
60 $\rightarrow$ 50	55	377	3770	298	153	6.4
50 $\rightarrow$ 40	45	334	3340	269	150	12.6
40 $\rightarrow$ 30	35	291	2910	237	149	18.8
30 $\rightarrow$ 20	25	252	2520	199	153	25.2
20 $\rightarrow$ 10	15	138	1380	152	110	29.8

DRAWDOWN TIME  
 $\approx$  30 days

\*\*\*\*\*  
 REC-1 VERSION DATED JAN 1973  
 UPDATED AUG 74  
 CHANGE NO. 01  
 \*\*\*\*\*

NATIONAL DAM INSPECTION PROGRAM  
 BOG BROOK RESERVOIR  
 PMF HYDROGRAPH

JOB SPECIFICATION  
 NQ MHR NMN IDAY IHR IMIN METRC IPLT IPRT NSTAN  
 50 1 30 1 0 0 0 0 2 0  
 JOPER NMJ  
 5 0

MULTI-PLAN ANALYSES TO BE PERFORMED  
 NPLAN= 1 NRTIO= 5 LRTIO= 1

RIIOS= .20 .40 .60 .80 1.00

\*\*\*\*\*

SUB-AREA RUNDEF COMPUTATION

ISTAQ ICOMP IECON ITAPE JPLT JPRT INAME  
 1 0 0 0 0 0 0 0

HYDROGRAPH DATA  
 IHYGC IJHG TJAREA SNAP TRSDA TRSPC RATIO ISNOW ISAME LOCAL  
 0 1 80.28 0.00 0.00 0.00 0.00 0 0 0

A-15

PRECIP DATA  
 NP STORH DAJ DAK  
 8 0.00 0.00 0.00  
 PRECIP PATTERN  
 .50 .60 1.80 2.00 3.10 9.00 .70 .70

LOSS DATA  
 STRKR DLISR RIJOL ERAIN STRKS RIJOK STRIL CNSIL ALSHX RTIMP  
 0.00 9.00 1.00 0.00 0.00 1.00 0.00 .10 0.00 0.00

UNIT HYDROGRAPH DATA  
 TP= 9.00 CP= .63 NTA= 0

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 6.86 AND R= 5.37 INTERVALS  
 REGRESSION DATA  
 STRIO= 0.00 QPCSN= 0.00 RIIOE= 1.00

UNIT HYDROGRAPH 33 END-OF-PERIOD ORDINATES, LAG= 8.97 HOURS, CP= .63 VOL= 1.00  
 232. 847. 1675. 2557. 3272. 3650. 3614. 3182. 2640. 2190.  
 1817. 1507. 1250. 1037. 861. 714. 592. 491. 408. 339.  
 281. 233. 193. 160. 133. 110. 91. 76. 63. 52.  
 43. 36. 30.

END-OF-PERIOD FLOW  
 TIME RAIN EXCS COMP Q  
 1 1 30 .50 .35 81.  
 1 2 60 .60 .45 401.  
 1 4 30 1.80 1.65 1350.

1	7	30	3.10	2.95	7310.
1	8	60	9.00	8.85	14615.
1	10	30	.70	.55	25602.
1	11	60	.70	.55	37772.
1	13	30	0.00	0.00	48735.
1	14	60	0.00	0.00	55943.
1	16	30	0.00	0.00	58031.
1	17	60	0.00	0.00	55024.
1	19	30	0.00	0.00	48113.
1	20	60	0.00	0.00	40339.
1	22	30	0.00	0.00	33565.
1	23	60	0.00	0.00	27845.
2	1	30	0.00	0.00	23100.
2	2	60	0.00	0.00	19163.
2	4	30	0.00	0.00	15897.
2	5	60	0.00	0.00	13188.
2	7	30	0.00	0.00	10941.
2	8	60	0.00	0.00	9076.
2	10	30	0.00	0.00	7530.
2	11	60	0.00	0.00	6245.
2	13	30	0.00	0.00	5182.
2	14	60	0.00	0.00	4299.
2	16	30	0.00	0.00	3566.
2	17	60	0.00	0.00	2958.
2	19	30	0.00	0.00	2454.
2	20	60	0.00	0.00	2036.
2	22	30	0.00	0.00	1689.
3	1	30	0.00	0.00	1401.
3	1	30	0.00	0.00	1182.
3	2	60	0.00	0.00	956.
3	4	30	0.00	0.00	782.
3	5	60	0.00	0.00	608.
3	7	30	0.00	0.00	458.
3	8	60	0.00	0.00	307.
3	10	30	0.00	0.00	36.
3	11	60	0.00	0.00	16.
3	13	30	0.00	0.00	0.
3	14	60	0.00	0.00	0.
3	16	30	0.00	0.00	0.
3	17	60	0.00	0.00	0.
3	19	30	0.00	0.00	0.
3	20	60	0.00	0.00	0.
3	22	30	0.00	0.00	0.
3	23	60	0.00	0.00	0.
4	1	30	0.00	0.00	0.
4	2	60	0.00	0.00	0.

SUM 16.40 17.20 591252.

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
59031.	54436.	32332.	12318.	591255.
INCHES	6.31	15.29	17.13	17.13
AC-FT	27006.	65473.	73334.	73334.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 1

16.	270.	695.	1662.	2923.	5120.	7554.	9747.	11189.
11606.	9623.	9068.	6713.	5569.	4620.	3833.	3179.	2636.
2189.	1506.	1249.	1036.	860.	713.	592.	491.	407.
338.	232.	191.	156.	122.	92.	61.	7.	3.
0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
11606.	10997.	6598.	2464.	119251.
INCHES	10.997.	6.598.	2.464.	10.997.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 2

32	160.	540.	1390.	2924.	5846.	10241.	15109.	19495.	22377.
2321	22010.	13245.	16135.	13426.	11138.	9240.	7665.	6359.	5275.
4376.	3631.	3012.	2499.	2073.	1720.	1426.	1183.	982.	816.
676.	560.	465.	382.	313.	243.	183.	123.	14.	7.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK 6-HOUR 24-HOUR 72-HOUR TOTAL VOLUME

DES	23212.	21774.	13197.	4927.	236502.
INC-ES	2.52	6.12	6.85	6.85	
AC-FT	10802.	26189.	29334.	29334.	

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 3

49.	240.	810.	2085.	4386.	8769.	15361.	22663.	29242.	33566.
34819.	33014.	24868.	20139.	16707.	13860.	11498.	9538.	7913.	
6564.	5446.	4518.	3748.	3109.	2579.	1775.	1473.	1222.	
1013.	841.	637.	573.	469.	365.	184.	22.	10.	
0.	0.	0.	0.	0.	0.	0.	0.	0.	

PEAK 6-HOUR 24-HOUR 72-HOUR TOTAL VOLUME

DES	34819.	32660.	19795.	7391.	354753.
INC-ES	3.78	9.18	10.28	10.28	
AC-FT	16204.	39284.	44000.	44000.	

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 4

65.	321.	1080.	2780.	5848.	11692.	20481.	30218.	38889.	44755.
46425.	44019.	32270.	26852.	22276.	18480.	15331.	12718.	10551.	
8753.	7261.	6024.	4997.	3439.	2853.	2367.	1963.	1629.	
1351.	1121.	930.	765.	486.	367.	29.	13.	13.	
0.	0.	0.	0.	0.	0.	0.	0.	0.	

PEAK 6-HOUR 24-HOUR 72-HOUR TOTAL VOLUME

DES	46425.	43547.	26394.	9854.	473004.
INC-ES	5.05	12.23	13.70	13.70	
AC-FT	21605.	52378.	58667.	58667.	

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 5

81.	401.	1350.	3475.	7310.	14615.	25602.	37772.	48736.	55943.
53031.	55024.	48113.	40338.	33525.	27445.	23100.	19163.	15897.	13188.
10941.	9076.	730.	6246.	5182.	4299.	3566.	2958.	2454.	2036.
1689.	1401.	1162.	956.	782.	608.	450.	307.	36.	16.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK 6-HOUR 24-HOUR 72-HOUR TOTAL VOLUME

DES	58031.	54434.	32922.	12318.	591255.
INC-ES	6.31	15.29	17.13	17.13	
AC-FT	27006.	65473.	73334.	73334.	

HYDROGRAPH ROUTING

STIAQ	ICOMP	TECON	ITAPE	JPLI	JPRI	INAME
2	1	0	0	0	0	0
ROUTING DATA						
QLOSS	CLOSS	AVG	IKES	ISAME		
0.0	0.000	0.00	1	1		

STORAGE= 0. 1423. 3762. 5026. 5369. 7734. 9287. 10863. 12516. 14249.

OUTFLOW= 0. 3056. 11214. 16428. 22266. 28667. 35585. 42986. 61067. 88052.



4247.	3732.	3270.	2874.	2520.	2215.	1954.	1733.	1547.	1384.
1231.	1086.	950.	826.	713.	611.	518.	434.	350.	272.
211.	162.	125.	97.	75.	58.	44.	34.	26.	20.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
JES	41150.	39620.	25482.	9054.	473113.
INC4ES	4.59	11.81	13.70		13.71
AC-FI	19656.	50570.	58663.		58681.

STATION		2, PLAN 1, R110 5	
81.	118.	291.	776.
51040.	55475.	52310.	45729.
16219.	13690.	11496.	9800.
2945.	2625.	2318.	2030.
529.	408.	315.	243.
			187.
			144.
			111.
			86.
			66.
			51.

STOR	
39.	56.
11599.	12005.
4975.	4362.
1415.	1261.
254.	196.
	140.
	11716.
	11118.
	13364.
	975.
	117.
	151.
	880.
	10347.
	2949.
	848.
	90.
	69.
	54.
	3445.
	5580.
	7386.
	2002.
	522.
	421.
	32.
	25.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
JES	55475.	51153.	31931.	12318.	591397.
INC4ES	5.93	14.00	17.13		17.13
AC-FI	25328.	63367.	73337.		73352.

PEAK FLOW SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS

OPERATION	STATION	PLAN	.20	.40	.50	.60	.80	1.00
-----------	---------	------	-----	-----	-----	-----	-----	------

HYDROGRAPH AT	1	1	11606.	23212.	34019.	46425.	58031.
	2	2	0.	0.	0.	0.	0.
ROUTED TO	1	1	9757.	20242.	30710.	41160.	55475.
	2	2	0.	0.	0.	0.	0.

PREVIOUS INSPECTION REPORT

Printed on one of these forms is completely satisfactory for each day in your district, return it at once to the  
 State of New York, Albany.

STATE OF NEW YORK  
 CONSERVATION COMMISSION  
 ALBANY

DAM REPORT

August 5th, 1915

CONSERVATION COMMISSION,

DIVISION OF INLAND WATERS.

GENTLEMEN:

I have the honor to make the following report in relation to the structure known as

Bog Brook Dam.

This dam is situated upon the

(Give name of stream)

in the Town of South East, Putnam County,

about 1 1/2 miles from the Village of Brewster

The distance from the dam, to the

(Give name of nearest important stream or of a body of water)

is about 8 miles

(Give distance)

The dam is now owned by New York City

(Give name of owner and how he felt)

and was built in or about the year 1894, and was extensively repaired or reconstructed

during the year

As it now stands, the spillway portion of this dam is built of

(Give material of spillway)

and the other portions are built of

(State whether of masonry, concrete, earth or timber, and give details of construction)

As nearly as I can learn, the character of the foundation bed under the spillway portion

of the dam is

and under the remaining portions such

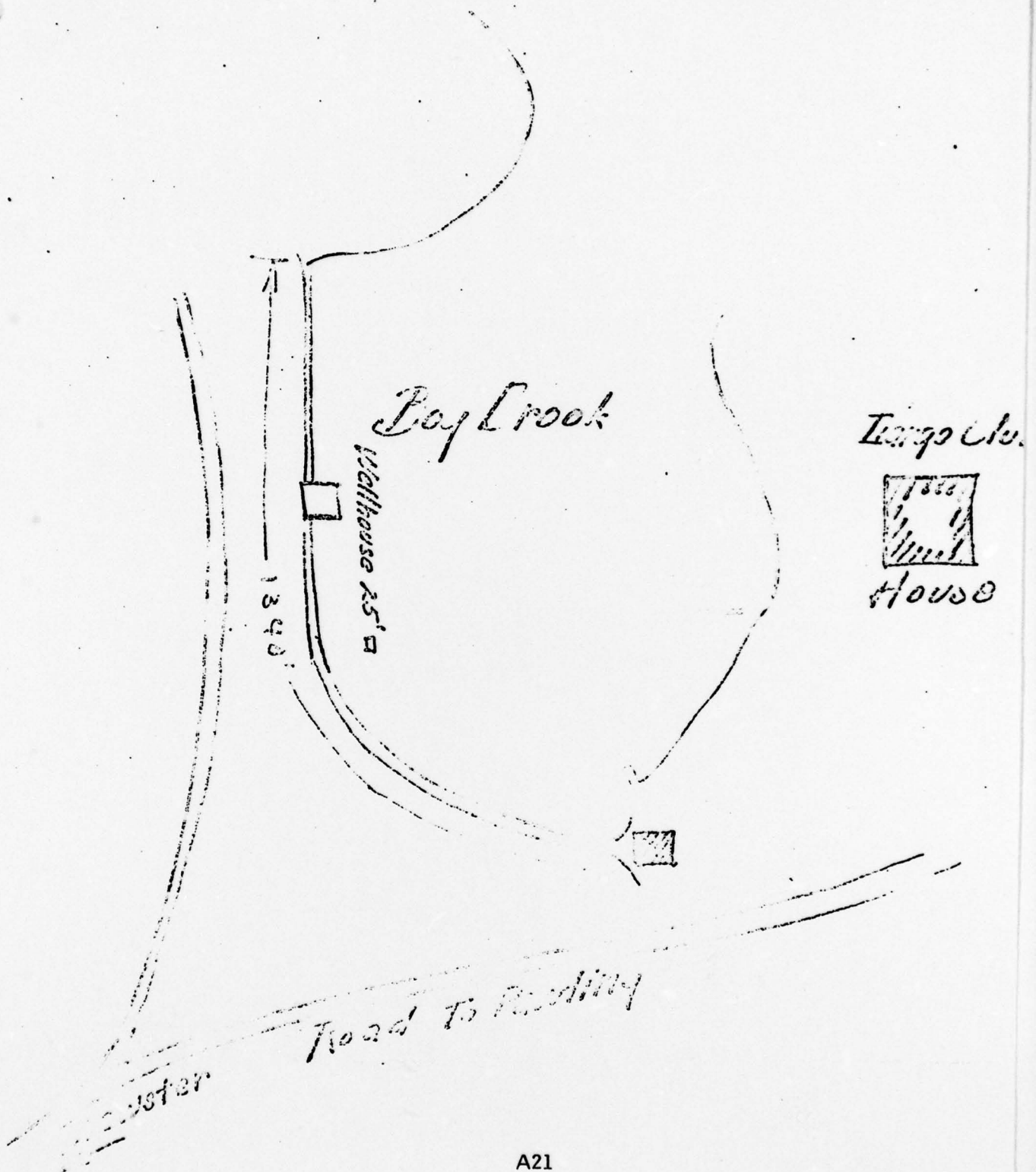
foundation bed is

A20

LH

Map 231-525

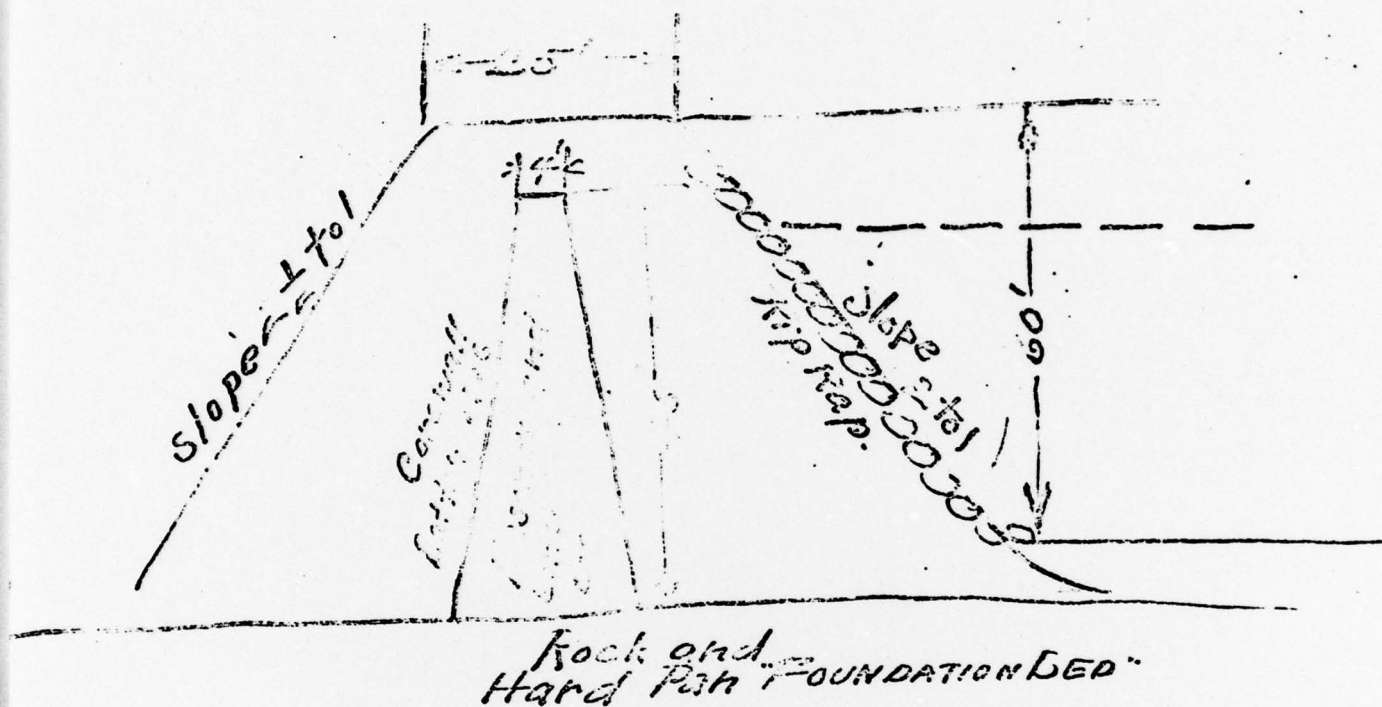
(In the space below, make a third sketch showing the general plan of the dam, and its approximate position in relation to buildings and other conspicuous objects in the vicinity.)



A21

In the space below, make one sketch showing the form and dimensions of a cross section through the spillway or waste-weir of this dam, and a second sketch showing the same information for a cross section through the other portion of the dam. Show particularly the greatest height of the dam above the stream bed, its thickness at the top, and thickness at the bottom, as nearly as you can learn.)

ONLY ONE SECTION NO SPILLWAY



What pressure against the foundation?  
+ the weight of the dam?

The total length of this dam is 1240 feet. The spillway or waste-  
way portion, is about 100 feet long, and the crest of the spillway is  
about 10 feet below the top of the dam.

The number, size and location of discharge pipes, waste pipes or gates which may be used  
for drawing off the water from behind the dam, are as follows: Two 30" pipes  
near mill house as shown

At the time of this inspection the water level above the dam was 2.5 ft. in.  
below the crest of the spillway.

(State briefly, in the space below, whether, in your judgment, this dam is in good condition, or bad condition, describing particularly  
any leaks or cracks which you may have observed.)

This dam seems to be in  
good condition and with a  
possibility of giving  
away. If the dam did break  
there would be caused quite  
a large loss to property owners  
on account of the lake being  
so near the town.

Reported by L. J. Johnson

Wood St. N.Y.

STATE OF NEW YORK

DEPARTMENT OF

State Engineer and Surveyor

ALBANY

Report of a Structure Impounding Water

To assist in carrying out the provisions of Section 22 of the Conservation Law, being Chapter LXV of the Consolidated Laws of New York State, relating to safeguarding life and property and the erection, reconstruction, or maintenance of structures for impounding water, owners of such structures are requested to fill out as completely as possible this report form for each such dam or reservoir owned within the State of New York for which no plans or reports relative thereto are on file in this Department, and to return this report form, together with prints or photographs explanatory thereof to this department.

1. The structure is on Bog Brook Dam, No. 1 flowing into Croton Ri  
Bog Brook in the  
Town of Southeast County of Putnam and New York  
about a quarter of a mile S.E. from the Cross Roads in Sodom, Putnam  
Co., New York. (Give distance and direction from a well-known bridge, dam, village main cross-roads or mouth of a stream)
2. Is any part of the structure built upon or does its pond flood any State lands? no
3. The name and address of the owner is the City of New York
4. The structure is used for impounding water for water supply
5. The material of the right bank, in the direction with the current, is \_\_\_\_\_; at the spillway crest elevation this material has a top slope of \_\_\_\_\_ inches vertical to a foot horizontal on the center line of the structure, a vertical thickness at this elevation of \_\_\_\_\_ feet, and the top surface extends for a vertical height of \_\_\_\_\_ feet above the spillway crest.
6. The material of the left bank is \_\_\_\_\_; has a top slope of \_\_\_\_\_ inches to a foot horizontal, a thickness of \_\_\_\_\_ feet and a height of \_\_\_\_\_ feet.
7. The natural material of the bed on which the structure rests is (clay, sand, gravel, boulders, granite, shale, slate, limestone, etc.) sand, gravel and hardpan.
8. State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect of exposure to air and to water, uniformity, etc.

9. If the bed is in layers, are the layers horizontal or inclined? ..... If inclined what is the direction of the horizontal outcropping relative to the axis of the main structure and the inclination and direction of the layers in a plane perpendicular to the horizontal outcropping? .....

10. What is the thickness of the layers? .....

11. Are there any porous seams or fissures? .....

by Bog Brook Dams Nos. 1 and 2

12. The watershed at the above structure and draining into the pond formed hereby is 3.67 square miles.

13. The pond area at the spillway crest elevation is 399 acres and the pond impounds 586 million cubic feet of water.

14. The maximum known flow of the stream at the structure was ..... cubic feet per second on

(Date) .....

15. Has the spillway capacity ever been exceeded by a high flow? no

Can any possible flood flow from the pond otherwise than through the wastes noted under 17 and 18 of this report? no If so, give the location, the length and the elevation relative to the spillway crest and the character and slopes of the ground of such possible wastes.....

~~No great damage to life or property would be caused by the failure of the dam.~~

16. State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the above structure. Describe the location, the character and the use of buildings below the structure which might be damaged by any failure of the structure; of roads adjacent to or crossing the stream below the structure, giving the lowest elevation of the roadway above the stream bed and giving the shape, the height and the width of stream openings; and of any embankments or steep slopes that any flood could pass over. Also indicate the character and use made of the ground below the structure. ....

No great damages or loss of life would be caused by the failure of the dam.

17. WASTES. The spillway of the above structure is ..... feet long in the clear; the waters are held at the right end by a ..... the top of which is ..... feet above the spillway crest, and has a top width of ..... feet; and at the left end by a ..... the top of which is ..... feet above the spillway crest, and has a top width of ..... feet.

18. There is also for flood discharge <sup>2</sup> pipes 36 inches inside diameter and the bottom is 11 feet below the ~~spillway crest~~ <sup>top of the dam</sup> and a (sluice, gate outlet) ..... feet wide in the clear by ..... feet high, and the bottom is ..... feet below the spillway crest.

19. Apron. Below the spillway there is ~~no apron~~ <sup>(Masonry)</sup> ~~of a masonry apron~~ channel, .....  
The downstream side of the apron has a thickness of ..... feet  
for a width of ..... feet.

20. Has the structure any weaknesses which are liable to cause its failure in high flows? .....

no

21. SKETCHES. On the back of this report make a sketch to scale for each different cross-section of the above structure at the greatest depth; giving the height and the depth from the surface of the foundation, the bottom width, the top width (for a concrete or masonry spillway at two feet below the crest), the elevation of the top in reference to the spillway crest, the length of the section, and the material of which the section is constructed; on the spillway section show a cross section of the apron, giving its width, thickness and material, and show the abutment or wash wall at the end of the spillway, giving its heights and thickness. Mark each section with a capital letter. Also sketch a plan; show the above sections by their top lines, giving the mark and the length of each; the openings by their horizontal dimensions; the abutments by their top width and top lengths from the upstream face of the spillway section; and outline the apron. Also sketch an elevation of each end of the structure with a cross section of the banks, giving the depth and width excavated into the banks.

22. WATER SUPPLY. The waters impounded by the above structure have (not) been used for a public water supply since 1891 by the City of New York.

Spillway. There is no spillway for this dam as the Bog Brook Reservoir is connected by a tunnel with the Sodom Reservoir, which has a spillway, 500 feet wide.

NOTE: If you are using one of these forms as completely as possible for each dam in your district, return it at once to the  
 Conservation Commission, Albany.

STATE OF NEW YORK  
 CONSERVATION COMMISSION  
 ALBANY

DAM REPORT

August 5th, 1915  
 Day

CONSERVATION COMMISSION,

DIVISION OF INLAND WATERS.

GENTLEMEN:

I have the honor to make the following report in relation to the structure known as  
 the Bog Brook Auxilliary Dam.

This dam is situated upon the Bog Brook Reservoir  
 in the Town of South East, Putnam County,  
 about 1  $\frac{3}{4}$  miles from the Village of Brewster

The distance from the dam, to the stream from the dam, to the nearest important stream or of a bridge  
 is about 1/2 mile (State distance)

The dam is now owned by New York City  
 and was built in or about the year 1897, and was extensively repaired or reconstructed  
 during the year —

As it now stands, the spillway portion of this dam is built of stone  
 and the other portions are built of concrete

As nearly as I can learn, the character of the foundation bed under the spillway portion  
 of the dam is — and under the remaining portions such  
 foundation bed is —

Map 23! C27

(In the space below, make a third sketch showing the general plan of the dam, and its approximate position in relation to buildings, or other conspicuous objects in the vicinity.)

← ROAD South to BREWSTER.

Date on Dam

Hill or  
Settling land.

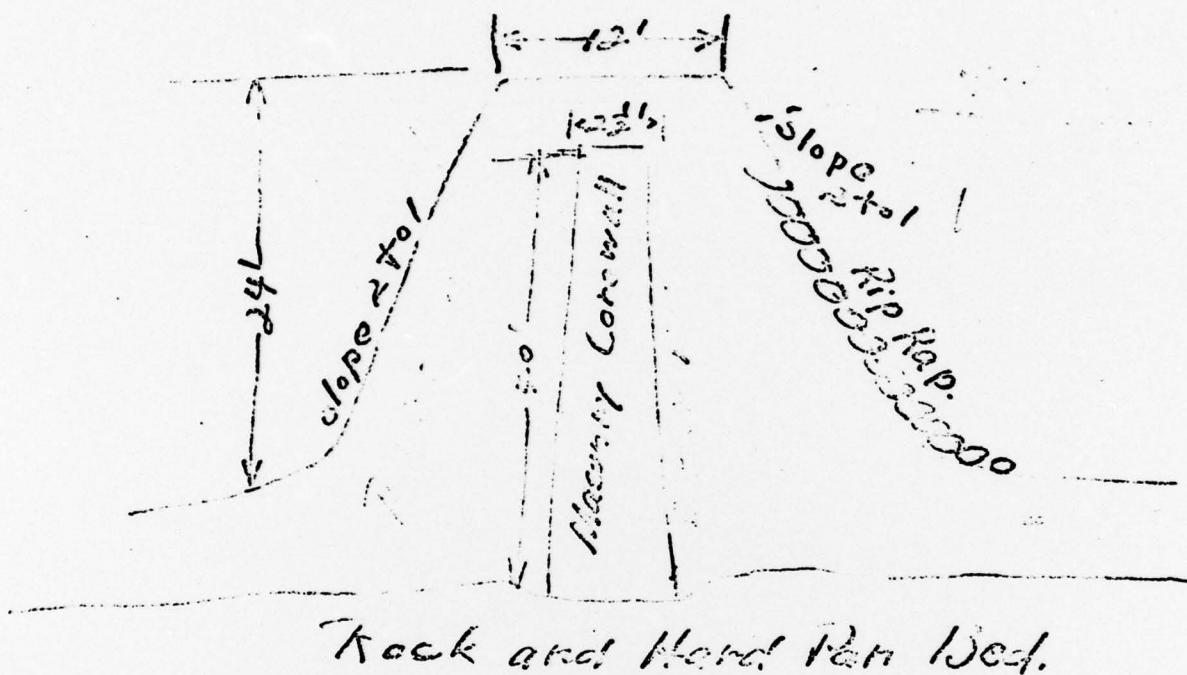
Dug Brook Reservoir.

← Dug Brook  
Reservoir

This dam is built by  
the Dug Brook  
Company

In the space below, make one sketch showing the form and dimensions of a cross section through the spillway or waste-weir of this dam, and a second sketch showing the same information for a cross section through the other portion of the dam. Show particularly the general nature of the dam above the stream bed, its thickness at the top, and thickness at the bottom, as nearly as you can learn.)

No spillway & Only one c.c.



The crest of the dam is 17.5 feet. The spillway or waste-  
way, however, is 10 feet long, and the crest of the spillway is  
1.5 feet below the top of the dam.

The number, size and location of discharge pipes, waste pipes or gates which may be used  
for drawing off the water from behind the dam, are as follows:

Three outlets

At the time of this inspection the water level above the dam was 5.5 ft. 0 in.  
above the crest of the spillway.

State below, in the space below, whether, in your judgment, this dam is in good condition, or bad condition, describing particularly  
any leaks or cracks which you may have observed.

This dam seemed to be in  
good condition with no likelihood  
of being away or cause it is  
built more of a dike than a  
stone wall. It has a base  
of 5 feet and a height of  
17.5 feet. The foundation  
is on a bed of sand.

Reported by W. J. [Signature]

(A Form No. 1, U. S. Bureau of Reclamation, U. S. Department of the Interior)

STATE OF NEW YORK  
DEPARTMENT OF  
**State Engineer and Surveyor**  
ALBANY

## Report of a Structure Impounding Water

To assist in carrying out the provisions of Section 22 of the Conservation Law, being Chapter LXV of the Consolidated Laws of New York State, relating to safeguarding life and property and the erection, reconstruction, or maintenance of structures for impounding water, owners of such structures are requested to fill out as completely as possible this report form for each such dam or reservoir owned within the State of New York for which no plans or reports relative thereto are on file in this Department, and to return this report form, together with prints or photographs explanatory thereof to this department.

1. The structure is Bog Brook Dam No. 2 at the Bog Brook Reservoir in the  
Town of Southeast County of Putnam State New York  
About 1-1/10 miles north of Bog Brook Dam No. 1 center to center  
(Give exact distance and direction from a well-known bridge, dam, village main cross-roads or mouth of a stream)

2. Is any part of the structure built upon or does its pond flood any State lands? no  
3. The name and address of the owner is City of New York

4. The structure is used for impounding water for water supply

5. The material of the right bank, in the direction with the current, is \_\_\_\_\_; at the  
spillway crest elevation this material has a top slope of \_\_\_\_\_ inches vertical to a foot horizontal on the  
center line of the structure, a vertical thickness at this elevation of \_\_\_\_\_ feet, and the top surface extends  
for a vertical height of \_\_\_\_\_ feet above the spillway crest.

6. The material of the left bank is \_\_\_\_\_; has a top slope of \_\_\_\_\_ inches  
to a foot horizontal, a thickness of \_\_\_\_\_ feet and a height of \_\_\_\_\_ feet.

7. The natural material of the bed on which the structure rests is (clay, sand, gravel, boulders, granite, shale,  
slate, limestone, etc.) Bed. clay 1 and hardpan

8. State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect  
of exposure to air and to water, uniformity, etc.

9. If the bed is in layers, are the layers horizontal or inclined? ..... If inclined what is the direction of the horizontal outcropping relative to the axis of the main structure and the inclination and direction of the layers in a plane perpendicular to the horizontal outcropping? .....

10. What is the thickness of the layers? .....

11. Are there any porous seams or fissures? .....

12. The watershed at the above structure and draining into the pond formed thereby is <sup>by Dog Creek Res. Nos. 1 & 2</sup> 3.67 square miles.

13. The pond area <sup>of the Dog Creek Reservoir</sup> at the spillway crest elevation is <sup>329</sup> ..... acres and the pond impounds <sup>568 - 11</sup> ..... cubic feet of water.

14. The maximum known flow of the stream at the structure was ..... cubic feet per second on

(Date) .....

15. Has the spillway capacity ever been exceeded by a high flow? No. .....

Can any possible flood flow from the pond otherwise than through the wastes noted under 17 and 18 of this report? No. ..... If so, give the location, the length and the elevation relative to the spillway crest and the character and slopes of the ground of such possible wastes .....

16. State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the above structure. Describe the location, the character and the use of buildings below the structure which might be damaged by any failure of the structure; of roads adjacent to or crossing the stream below the structure, giving the lowest elevation of the roadway above the stream bed and giving the shape, the height and the width of stream openings; and of any embankments or steep slopes that any flood could pass over. Also indicate the character and use made of the ground below the structure. ....

16. No great damages could be caused if the dam should fail. .....

17. WASTES. The spillway of the above structure is ..... feet long in the clear; the waters are held at the right end by a ..... the top of which is ..... feet above the spillway crest, and has a top width of ..... feet; and at the left end by a ..... the top of which is ..... feet above the spillway crest, and has a top width of ..... feet.

<sup>no</sup>  
18. There is ~~322467~~ flood discharge a pipe ..... inches inside diameter and the bottom is ..... feet below the spillway crest; and a (sluice, gate outlet) ..... feet wide in the clear by ..... feet high, and the bottom is ..... feet below the spillway crest.

19. APRON. Below the spillway there is <sup>no</sup> ~~an~~ apron ~~material~~ <sup>(Material)</sup> \_\_\_\_\_ feet wide and \_\_\_\_\_ feet thick. The downstream side of the apron has a thickness of \_\_\_\_\_ feet for a width of \_\_\_\_\_ feet.

20. Has the structure any weaknesses which are liable to cause its failure in high flows? No

21. SKETCHES. On the back of this report make a sketch to scale for each different cross-section of the above structure at the greatest depth; giving the height and the depth from the surface of the foundation, the bottom width, the top width (for a concrete or masonry spillway at two feet below the crest), the elevation of the top in reference to the spillway crest, the length of the section, and the material of which the section is constructed; on the spillway section show a cross section of the apron, giving its width, thickness and material, and show the abutment or wash wall at the end of the spillway, giving its heights and thickness. Mark each section with a capital letter. Also sketch a plan; show the above sections by their top lines, giving the mark and the length of each; the openings by their horizontal dimensions; the abutments by their top width and top lengths from the upstream face of the spillway section; and outline the apron. Also sketch an elevation of each end of the structure with a cross section of the banks, giving the depth and width excavated into the banks.

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Spillway. There is no spillway for this dam as the Bog Brook Reservoir is connected by a tunnel with the Sodom Reservoir which is provided with a spillway, 500 feet wide.